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TREATMENT OF DISEASED TONSILS BY MEANS OF RADIUM *

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In making this report concerning a series of patients treated with radium and now under observation for a period of three years, I feel that enthusiasm for this method of treatment is fully warranted by the results obtained in the nose and throat department of Beth Israel Hospital. I do not, however, advocate radium as a substitute for tonsillectomy. It should be used only in those cases in which tonsillectomy is indicated, but in which surgery is inapplicable.

In performing a tonsillectomy the majority of surgeons remove the tonsil still enclosed in its capsule, so that immediately after the operation the faucial pillars appear intact and the faucial arch perfectly symmetrical; yet several months later, the throat presents a very different appearance. By this time granulations will have appeared and covered the exposed muscles, resulting in cicatricial tissue and contraction of pillars and arches. Such a result is especially undesirable if the patient is a singer, for this cicatrization of the muscles will interfere with their flexibility, thus changing the timbre of the voice.

The embryology of the tonsil has an important bearing on the subject. The tonsils develop about the fourth month of fetal life, and at birth there are fully developed masses of lymphoid tissue in the throat which are known as the faucial and lingual tonsils. Normally, from about the eighth to the tenth year of life these lymphoid masses undergo involution, and the lymphoid tissue atrophies and is replaced by fibrous tissue. If the tonsils become diseased, they do not atrophy, but instead react to the irritating influences thus induced and become hypertrophied. Such tonsils always harbor numerous bacteria, the toxins of which are supposed to be absorbed into the blood stream and thus become responsible for many acute clinical ailments. Thus hypertrophied tonsils, while normal in children, in adults are a definite sign of some interference with natural involution, and as such are to be considered diseased.

In submitting tonsils to the action of radium, the purpose is to cause a complete atrophy of the tonsil with a single dose. It has been proved that lymphoid tissue is much more sensitive to radium than is skin or

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muscle tissue, a fact which permits one to irradiate the tonsils without affecting the adjacent structures. In using radium for diseased tonsils, the aim is to induce atrophy by a combination of filtration and distance without causing necrosis or destruction of surrounding normal tissue. The point has now been reached where the tonsils can be irradiated without producing any inflammatory reaction. This is brought about by so filtering the rays that they will act on the nuclei of the cells so as to cause a chemical reaction and subject the substance to vacuolation and disintegration. This process takes place without any permanent injury to the surrounding structures. If irradiated tissue is examined microscopically three days after an erythema dose has been applied, a swelling of the cell bodies and a hyperchromatism of the nuclei will be noted. During the second and third week thereafter, the cytoplasm undergoes liquefaction, the cell membrane ruptures and the nuclei are broken up. This is followed by an inflammatory reaction with serous exudation and infiltration of lymphocytes, with formation of granulation tissue later. The final result is obliteration of the lymphoid tissue and its replacement by fibrous formation.

In watching tonsils after they have been irradiated, it will be noticed that the follicles undergo shrinkage so that finally the apertures are closed and completely obliterated. After about six months, the hypertrophied tonsils will be found to have greatly diminished in size, in some cases totally disappearing.

Radium, which is now being used extensively in pathologic conditions of the nose and throat, is a chemical element which with its products of disintegration gives off three different kinds of radiations known as alpha, beta and gamma rays. These rays differ from one another in physical nature, velocity and power of penetration. The alpha rays are the most irritant and easily absorbed, so that the thinnest sheet of paper can stop and absorb them. They are always absorbed by the radium container or screen and are never used therapeutically to the exclusion of the beta and gamma rays. The beta rays have a penetrating power one hundred times that of the alpha rays, while their velocity is ten times greater. They can easily be screened off by 2 mm. of brass or lead. The gamma rays, which have the greatest therapeutic value, are considered as electromagnetic, having a penetrating power from ten to one hundred times greater than that of the beta rays. They are analogous to the roentgen rays or ultraviolet rays, differing from these, however, by virtue of their shorter wave-length. The object in filtering the radiation for tonsillar application is to eliminate the caustic beta rays and permit the therapeutic gamma rays to exert their action without causing any necrosis of tissue.

The value of radium in clinical practice lies in its power to give off, spontaneously and uninterruptedly, rays which penetrate tissue and

cause change in the body cells. These rays maintain radiation as long as required, deferring action for periods of time varying from weeks to months. The radium as now applied is obtainable either in needle containers or radium emanation, properly filtered with brass, silver, gold or platinum, and is employed in place of the element. These screens eliminate the irritating alpha rays and most of the beta rays as well, and so prevent burns and necrosis.

Radium emanation is given off during the disintegration of radium into gas, and is collected by a special process in sealed capillary tubes of glass, or in special containers such as those of gold or platinum. Emanation is as effective as radium itself, and can be obtained at a price within the reach of all. The cheapest and most commonly used are the glass radon seeds, the gold and platinum naturally being much more expensive. The latter are now made removable. In using filtered radium emanation seeds, it is important that the emanation should not leak out, so that careful sealing is necessary.

Gold seeds or implants, by the screenage of which most of the beta rays are absorbed, are now used for implantation at the Memorial Hospital, New York, and have been found fully adequate for the purpose for which they are designed. The platinum radon seeds have a filter of 1.3 mm. platinum, which absorbs 98.57 per cent of the caustic beta rays, thus completely eliminating necrosis.

Some authorities object to the implantation of foreign bodies such as radium emanation seeds, as they believe that the source of radiation should be removed after the required dose has been delivered. This objection can now be overcome by employing either platinum needles or removable platinum radon seeds. While the platinum needles under proper filtration eliminate necrosis and sloughing, the disadvantages of the method lie in its improper distribution of the radiation, the discomfort and pain induced by its application and the continuous trauma which must go on during the entire period of radiation.

The removable platinum radon seed has none of these drawbacks. Its chief advantage lies in the possibility of its being easily removed by means of an attached silk thread after the required period of radiation, so that no foreign body is left in the tonsil. The seeds are so very small, being but 4 mm. in length and 1 mm. in diameter, that the patient suffers no discomfort during the period of radiation, so that this can now be extended from four to ten days. The seeds are screened with 0.3 mm. of platinum, thus eliminating 98.5 per cent of the caustic beta rays. These seeds can be sterilized by boiling. They contain an initial amount of radiation of 2.5 millicuries. The seed has a thread attached which after implantation protrudes from the point of entrance so that it can easily be seized when the seed is to be removed.

When 1 millicurie of radium emanation (radon) is embedded in the tonsil and allowed to remain until it has lost its activity and completely decayed, a dose amounting to 133⅓ millicurie hours is obtained. The emanation loses 0.75 per cent of its activity each hour; consequently, its activity has practically disappeared after one month. Since the period of half decay of radon is 3.85 days, the main effect is produced during the first week of its application, 99.5 per cent of its activity being lost in thirty days. This decay is rapid when compared to that of the element, which disintegrates very slowly, 1,780 years being the length of time estimated for the salts to lose half of their initial activity. Hence for practical purposes, radium salts may be considered as permanent.

When I first began to treat tonsils with radium, I used platinum needles containing 10 mg. of radium element which were inserted and kept in the tonsil for three hours. Six such treatments at two and three week intervals were applied.

The second method practiced in the clinic was the implantation of radium emanation in capillary glass tubes. Three or four of these were embedded in each tonsil by means of a hollow needle, each seed containing on an average, 0.28 millicuries of radium emanation. In several cases there was a severe reaction, for by this method the caustic rays are not eliminated, so that there is always danger of necrosis and sloughing. The seeds also must remain as foreign bodies, another serious drawback.

The third method, and the one which I now use, is the implantation of one removable platinum seed into each tonsil, this seed containing approximately 2.85 millicuries of radium emanation. The advantage of this method is that hospitalization of the patient is unnecessary, for it is a bloodless and painless procedure, capable of being performed in the office without an anesthetic. The dosage is so well controlled that surrounding tissues are undamaged; there is no scarring, no postoperative bleeding and no severe reactions such as are seen after tonsillectomy. Also, the dangers of endocarditis, lung abscess, aspiration pneumonia and middle-ear diseases are eliminated.

I discarded as an unnecessarily painful procedure the first method of plunging 10 mg. radium needles into the tonsils and leaving them for a given time, as the needles were large and had sharp points and thus caused the patient considerable discomfort; moreover, it was never certain that the proper distribution of the radiation would be obtained. The second method, that of using glass radon seeds, was satisfactory, except for the fact that the glass seeds had to remain in the tissue as foreign bodies. These glass seeds contained approximately from 0.25 to 0.28 millicuries each, so that I was obliged to use three or four seeds distributed equally in each tonsil. This was accomplished by plunging the sterilized seed into the tonsil with a hollow needle having a plunger

at the other end. This method was abandoned when it was possible to obtain removable seeds, as the permanent foreign bodies were objectionable.

The third method, and the one now in use, is the implantation of one platinum radon seed into each tonsil, allowing it to remain there for four days. Each seed contains about 2.85 millicuries of radium emanation. A series of more than 100 patients has now received treatment at our hands, being divided into three groups according to the method employed in treatment. In the first group were about sixty patients in whose cases platinum radium needles were used; the second group consisted of thirty-three patients treated with glass radon seeds left in situ; while the third and last group was made up of twelve patients in whose cases removable platinum radon seeds were employed. Because of lack of space, only six cases from each group will be presented in detail.

No local reaction was noted in any case. A noticeable change in the tonsil was apparent about the fourth week, the mass gradually shrinking in size, thereby obliterating the crypts and thus eliminating the focus of infection. At about the third month, the tonsils were just behind the anterior pillars, while at the sixth and ninth month, they could be distinguished only as fibrous nodules.

REPORT OF FIRST SERIES OF CASES: TREATMENT BY IMPLANTATION OF RADIUM NEEDLES

CASE 1.—I. L., a woman, aged 55, was referred by the Workman's Circle Medical Department, with a diagnosis of cancer of the tonsil made by Dr. Wolff Freudenthal. The history showed that this woman had suffered with sore throat for five years past and had recently experienced pain in the joints. Examination showed both tonsils enlarged to a remarkable extent. The follicles were open and filled with cheesy material. A small piece of the right tonsil was removed and examined for malignancy. The pathologic report showed a specimen to be fibrous and epithelial tissue, with no evidence of malignancy.

Treatment was commenced on Nov. 7, 1923. A 10 mg. radium needle was inserted into each tonsil and left in situ for three hours. Six such treatments were administered at intervals of one and two weeks. Diminution in the size of the tonsils was noticeable at about the fourth treatment, and from then on the tonsils grew smaller and smaller, and the follicles disappeared. The patient was free from joint symptoms at the end of the sixth week; after the fourth month the tonsils were atrophied and visible only behind the anterior pillars. The patient was extremely happy; she did not have any pain in the joints, and the throat felt well.

This woman was seen by me again on two occasions during the succeeding year (1925), at which time she was absolutely free from joint symptoms and sore throat. The tonsils were small masses of fibroid tissue visible only on retraction of the anterior pillars. The woman was reexamined in June, 1926; the observations were similar to those at the preceding examination.

CASE 2.—G. K., a woman, aged 57, had suffered with sore throat intermittently for a number of years past. Since the last attack of tonsillitis she had had pain in the joints, especially in the knees and shoulders, for which she sought relief. Examination showed this patient to have diseased, hypertrophied tonsils which were partly submerged. A pus sac formed by a dilated follicle was visible in the right tonsil.

Treatment was commenced on Dec. 13, 1923. A 10 mg. radium needle was inserted in each tonsil and kept there for three hours. Six such treatments at an interval of one week were given. At the end of the third week, there was relief from all the joint symptoms; the tonsils shrank in size until they were very small; at the end of the fourth month, they were almost unnoticeable. The patient has had no further joint symptoms, nor any return of sore throat.

I observed this patient for the next two years; each examination revealed small fibrous masses in each tonsillar fossa, just barely visible without retracting the anterior pillar. The woman has been completely free from sore throat and joint symptoms during this entire period.

Case 3.—Y. L., a woman, aged 48, had been complaining of sore throat for several years past, and had been ill with rheumatism on several occasions. During the last attack of tonsillitis, she had agonizing pain in the right shoulder and both knees. Examination showed both tonsils cryptic, submerged and diseased. A cheesy material was obtained when pressure was applied.

Treatment was commenced on Jan. 22, 1923. A 10 mg. needle was inserted in each tonsil and kept in place for three hours. Subsequently, she received five treatments at intervals of one or two weeks. At the fifth treatment, a slight reaction resulted. A small yellowish spot appeared at the point of entrance of the needle in the right tonsil, which was slightly painful. This spot gradually became a whitish superficial ulcer, but disappeared in the course of a week. At the end of the third month, the tonsils had shrunk to about one-fourth their original size; the follicles disappeared and the patient felt well, being free from all pain in the shoulder and knees. Later examination showed the tonsils completely atrophied except for the lower poles, which were still visible. There was no further complaint of any of the previously manifested symptoms.

Case 4.—A. B., a man, aged 35, referred by the Workman's Circle Medical Clinic, gave a history of being a "bleeder." When four teeth had been removed six months before, he had bled for six days before the hemorrhage could be controlled. Two brothers were also bleeders, one almost losing his life from a hemorrhage occurring during the extraction of teeth. The patient had been ill for the past two years with frequent severe attacks of tonsillitis. Examination showed enlarged tonsils, with wide open follicles, and when compressed they exuded a greenish cheesy material.

Treatment was commenced on March 6, 1923. Ten milligram radium needles were inserted in each tonsil and kept there for three hours. In all, five treatments were given at intervals of from four to six weeks, because the patient's attendance at the clinic was rather irregular. At the third treatment there was a reaction, the tonsils being slightly inflamed and painful, but this lasted only three days. Improvement commenced at the tenth week, the tonsils gradually shrinking, the follicles closing, and finally disappearing altogether. At the end of the sixth month, the tonsils were about one-fourth their original size, and at the last examination were so small that the anterior pillars had to be pushed back in order to view them; even then, only the lower poles were prominent. There was no tonsillitis during the following winter, and the patient felt very well.

Reexamination in 1926 showed the tonsils atrophied into fibrous tissue except for the lower poles, which were still prominent. The patient was conscious of "something there." In this case the needles evidently did not distribute the radiation evenly, the lower poles being left unaffected. This can easily be remedied by the insertion of a radon seed into each remaining pole, which will induce atrophy. The patient has promised to return later to have this done.

Case 5.—N. L., a man, aged 40, gave a history of frequent attacks of tonsillitis each year, but was in great fear of having the tonsils removed. A complete course of roentgen-ray treatment had had no effect. Examination showed both tonsils hypertrophied, submerged and very cryptic. A large deep crypt in which food could lodge indented the center of each tonsil, and cheesy material could be expressed from these follicles.

Treatment was commenced on Nov. 22, 1923. Five milligram radium needles were inserted into each tonsil and kept there for three hours. In all, he received five treatments at intervals of from two to three weeks. The tonsils shrank in size but very slowly, and the large crypts still remained. I then inserted three seeds in each tonsil, each seed containing 0.3 millicuries of radium emanation. The result has been gratifying. This patient has been under observation for three years; the tonsils are now almost imperceptible; the dilated crypts have been obliterated, and there have been no more attacks of tonsilitis.

CASE 6.—C. S., a woman, aged 42, had had repeated attacks of tonsillitis, accompanied by rheumatic pains. There was a small cystic goiter. She had also a cardiac condition apparently caused by a focal infection emanating from the tonsils. The tonsils were considerably hypertrophied, with the follicles dilated and containing cheesy material.

Treatment consisted of inserting 10 mg. platinum needles for a three-hour period, four treatments in all being given; nevertheless, a gratifying result followed. The tonsils atrophied, and the joint symptoms disappeared at the end of the fourth month. The patient did not return for further observation.

SECOND SERIES: TREATMENT BY GLASS RADON SEEDS

CASE 1.—M. D., a man, aged 64, had a history of numerous attacks of tonsillitis which had kept him in bed on several occasions. He had had rheumatism for several years, together with joint symptoms, for the relief of which all his teeth had been removed, without benefit.

The treatment consisted in inserting three glass radon seeds into each tonsil, each seed containing approximately 1.36 millicuries of radium emanation. No reaction was apparent until the third day, when the patient experienced a slight sore throat, which, however, cleared up in three days. The tonsils gradually atrophied, so that six months later they were just visible. No further sore throat developed and the joint symptoms improved, although they did not disappear completely. These pains were afterward diagnosed as gouty symptoms, and gouty deposits were identified in the toes and fingers.

CASE 2.—R. F., a woman, aged 58, referred by Dr. S. J. Kopetsky, complained of frequent attacks of tonsillitis and pain in the joints. She had high blood pressure, nephritis and myocarditis. The tonsils were considered foci of infection and their removal was suggested, but as the woman was such a poor operative risk, radium treatment was advised instead of tonsillectomy.

Treatment consisted of the implantation of three glass radon seeds in each tonsil, each seed containing approximately 2.08 millicuries of radium emanation. A slight reaction followed, the tonsils being sore for three days. The end-result noted in this case nine months later, when the throat was again inspected, was complete atrophy except at the lower poles. This patient has been kept under observation for two years, during which time she has been free from sore throat. Her joint symptoms have been relieved markedly, although not entirely eliminated, and her general health has improved so that she herself is satisfied with the result.

CASE 3.—J. S., a young woman, aged 17, had a history of frequent sore throat. The tonsils were very much diseased and considered as the focus of infection for a large goiter which was producing exophthalmic symptoms. Tonsillectomy was refused.

The treatment given this girl consisted of the implantation of three glass radon seeds on either side, each seed containing approximately 2.85 millicuries of radium emanation. The tonsils atrophied completely, so that she was entirely free from tonsillitis, although her thyroid condition was not in any way affected, the exophthalmic symptoms persisting. She did not return for further observation.

CASE 4.—I. R., a man, aged 32, had a history of repeated attacks of sore throat, together with severe pains in all the joints, so that he could hardly walk, except when aided by a stick. Examination showed the tonsils to be hypertrophied and diseased. The man's bleeding time was twenty-four minutes and coagulation time twenty-eight minutes.

Because of the hemophiliac tendency, the treatment undertaken was the implantation of three glass radon seeds on each side, each seed containin 2.08 millicuries of radium emanatjon. A slight soreness of the throat was noticed for the first twenty-four hours. Six months later, the tonsils were found to have atrophied and the patient was free from joint symptoms, having discarded his cane three weeks after the treatment was applied.

CASE 5.—G. C., a youth, aged 17, had a history of hemophilia; after biting his tongue he had bled for three weeks, necessitating blood transfusion. Both tonsils were hypertrophied and diseased. He complained of pain in the muscles of the back and right knee.

The treatment consisted of implanting in each tonsil three glass radon seeds, each seed of a value of about 2.12 millicuries of radium emanation. This patient continued to bleed at the point of entry of the seed implanted for ten days, and the hemorrhage was controlled only after horse serum had been injected and thromboplastin applied locally. A good result, however, was noted in the end, for the tonsils atrophied completely, the joint symptoms disappeared, and there was no further sore throat.

CASE 6.—H. L. B., a man, aged 31, referred by Dr. Barkan, had a history of repeated attacks of sore throat necessitating confinement to bed for several days at each attack. He asserted that he was too cowardly to submit to tonsillectomy, either under general or local anesthesia. There were no joint symptoms, but the tonsils were very much enlarged, meeting at the center of the pharynx. The follicles were dilated, and cheesy material could be expressed from several crypts.

Treatment consisted of the implantation of three glass radon seeds in each tonsil, each seed being 2.85 millicuries in value. A gratifying result followed, the tonsils being so completely atrophied that only small fibrous masses remained visible on retraction of the anterior pillars. This patient was under observation for three years, and up to date has not had a single attack of sore throat since the radiation.

THIRD SERIES: TREATMENT BY REMOVABLE PLATINUM RADON SEEDS

CASE 1.—S. P., a woman, aged 49, referred by Dr. A. I. Ringer, had had attacks of sore throat for the past six years and suffered from joint pains which had kept her indoors for long periods. She had been under Dr. Ringer's care for the past year for diabetes, and there was considerable sugar in the urine. Examination of the tonsils showed them to be red, hypertrophied and cryptic, seropus oozing out from several of the crypts on pressure. She appeared very weak, and had to be assisted in getting about.

Treatment consisted of implanting one removable platinum radon seed into each tonsil, each seed containing approximately 2.82 millicuries of radium emanation. The seed was kept in place for four days and easily removed by the small thread to which it was attached. There was no reaction, and at the next examination the patient felt better, and in three weeks was able to get about without help. The tonsils gradually atrophied, leaving only fibrous masses. While all the joint symptoms have not disappeared, she has been free from sore throat and generally feeling well. She is still under observation.

CASE 2.—M. G., a man, aged 54, gave a history of frequent sore throat for the past six years, with increasing deafness. He also complained of fleeting

pains in the joints. Examination of the throat showed moderately hypertrophied and diseased tonsils with dilated follicles containing pus. Inspection of the ears revealed a beginning otosclerosis with diminished hearing.

Treatment consisted of the implantation of one removable platinum radon seed into each tonsil, the content of each seed being about 2.8 millicuries of radium emanation. The seeds were easily removed on the fourth day, no reaction being observed. The tonsils then gradually atrophied, and no further attacks of tonsillitis occurred. The patient feels better, and is now almost free from the joint pains. His hearing, however, has not been benefited.

CASE 3.—J. H., a man, aged 52, a printer, had a history of repeated attacks of tonsillitis which confined him to bed for several days at a time. He had been advised to have his tonsils removed, but had not had the courage to submit to operation. Examination of the throat showed the tonsils to be extremely large, meeting at the center of the pharynx, and so hypertrophied that the patient spoke as if he had a hot potato in his mouth.

Treatment consisted of the implantation on each side of one removable platinum radon seed with a value of approximately 2.81 millicuries of radium emanation. The seeds were removed on the fifth day without any reaction being noted. Four weeks later, the tonsils had already become smaller; they atrophied gradually until only fibrous tissue remained. No further attacks of tonsillitis occurred.

CASE 4.—R. P., a woman, aged 53, gave a history of typhoid fever as a child and an operation six years before consultation for removal of the appendix and fallopian tubes. She complained of having had attacks of sore throat and rheumatic pains for the past twelve years. Examination showed the tonsils to be enlarged moderately but markedly diseased. The pillars were red and adherent, and pus exuded from the left tonsil on squeezing. There was also a marked myocardial irregularity.

Treatment consisted of implantation of a removable seed in each tonsil, the initial value of each seed being 2.66 millicuries. These were withdrawn after five days. There was no reaction. When the patient returned for examination four weeks later, she was feeling better; she said that her throat was no longer sore. The tonsils had atrophied noticeably, and there was no further complaint of pain in the extremities. The crypt in the left tonsil which had contained pus had gradually closed up and had been obliterated entirely.

CASE 5.—I. C., a rabbi, aged 60, complained of sore throat, especially after singing. Examination revealed extremely hypertrophied tonsils, evidently diseased, from which cheesy material could be expressed on both sides. No joint symptoms were present.

Into each tonsil a 2.82 millicure platinum radon seed was inserted for a four-day period; when withdrawn there was no reaction. There were no further complaints of sore throat, and the tonsils shrank considerably in size, at the end of the third month being fully 50 per cent. less in volume than at the time of implantation. This patient is still under observation.

CASE 6.—T. P., a woman, aged 59, was referred for tonsillectomy, the diseased tonsils being regarded as the cause of joint symptoms. She gave a history of frequent sore throat which kept her from performing her household duties. Examination showed the tonsils to be red, submerged and evidently diseased; pus and seropus could be expressed from both sides.

Two platinum radon seeds containing 2.62 millicuries of radium emanation were implanted and withdrawn after the expiration of the four-day period, with no reaction. At the end of two months the patient was practically free from joint symptoms, while the size of the tonsils was appreciably diminished. At the end of the fourth month, they were visible only on retraction of the anterior pillars. This patient is still under observation.

CONCLUSIONS

The new removable platinum radon seed is a means of administering a definite dosage of radiation, of insuring complete elimination of necrosis and sloughing and of doing away with the presence of a permanent foreign body in the radiated tissue.

In cases in which there have been repeated attacks of severe tonsillitis in acute infection, the results of radiation may not be so marked. This is undoubtedly due to the fact that radiation exerts its effect on the lymphoid tissue only, and when because of repeated inflammation the tonsil has become fibrous, this tissue remains more or less resistant to radiation. In such tonsils, however, there is a gradual process of atrophy and disappearance of the crypts, as well as elimination of the focus of infection. To sum up, it is my opinion that the results obtained indicate that we now have a satisfactory method of removing diseased tonsils without the risk of fatalities in inoperable cases.

In the cases just detailed it will be seen that in the first group, in which the tonsils were treated by radium needles, in addition to the pain and gagging while the needles were kept in the tonsils for three hours, the results were not ideal. The lower poles did not receive any radiation in several instances, while a great many patients had a reaction lasting three days.

In the second group of cases in which the patients were treated with glass radon seeds, the results were better. The pain and gagging were done away with; the only objections were that the implantation necessitated from six to eight punctures, and the glass seeds had to be left permanently in situ so that they acted as foreign bodies; a slight reaction also followed implantation. The damage that these seeds would tend to do as foreign bodies is still, of course, only conjecture, as experience with this method of treatment is still insufficient to permit generalization. The reaction noted was undoubtedly due to the lack of complete screenage of the capillary glass tubes.

In the third group of cases in which the patients were treated with removable radon seeds, the ideal method appears to have been employed. In the first place, sufficient radiation is obtained by implanting only one seed instead of the three glass seeds before required; second, the seed can be removed, doing away with the presence of a foreign body; finally, no reaction was noted in any case, the platinum screenage being sufficient to prevent burns and necrosis.

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DIPHTHERIA INFECTION OF THE MIDDLE EAR AND MASTOID

REPORT OF TWO CASES *

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The purpose of this report is to present two cases in which the patients carried virulent diphtheria organisms in the middle ear and mastoid without clinical signs referable to the ear, and showed obscure but persistent general reactions. Alexander [1] observed the destruction of tissue in the tympanic and epitympanic spaces, without evident involvement of the drum membrane. In a recent thorough review Drury [2] cites briefly the facts in every case of diphtheria of the ear in the medical literature; the earliest reported depend on clinical signs for determination as virulent diphtheria; the later ones on guinea-pig inoculation, which is the absolute proof of the virulence of the organism. The two cases described here were selected from a group of cases of diphtheric infections of the mastoid, the remaining four being either secondary diphtheroid infections from wound contamination or infections not clearly primary in the middle ear space.

In both of the cases reported, the complete solution of the infantile mastoid structure and replacement with organized pyogenic membrane indicated an infection of long duration. Further, in case 1, the clinical course of the child for a year previous to the diagnosis of diphtheria of the mastoid, and the coincidence of the mother's pharyngeal diphtheria with the beginning of the child's vague troubles, is strong evidence that the patient had carried the diphtheria as a primary infection in the middle ear space without any signs in the nose or pharynx or symptoms referable to the ear.

REPORT OF CASES

CASE 1.—Dorothy D., aged 3½ years, was referred by a pediatrician, under whose care she had been since birth. She complained of earache and discharge from the left ear of three days' duration. The family history contained only the important information that the mother had had an attack of pharyngeal diphtheria one year previously, had received proper treatment and had recovered in a few days. This fact was recorded, but no weight was given it as bearing on this case until later. The child was normal at birth; she was breast fed; development and health were good until about one year before presentation, when she began to have attacks of diarrhea and loss of appetite, accompanied by a rise of temper-

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1. Alexander, G.: Diseases of the Ear, Philadelphia, J. B. Lippincott Co., 1918, pp. 159-168.

2. Drury, D. W.: Diphtheria of the Ear, Arch. Otolaryng. **1**:221-230 (Feb.) 1925.

ature. Examination by the physician showed no cause for the condition except a slightly red throat and mild rhinitis; the ear drums were always normal. The child stopped gaining weight, rested fitfully at night and required constant attention. It was decided that the tonsils and adenoids might be responsible, and they were removed. Her condition was not improved. She was observed regularly by a physician.

Three days before I examined the child, the physician was consulted for an earache on the left side accompanied by fever. The left ear drum, which had repeatedly been found normal, was dull, bulging slightly and discharging a profuse serosanguineous fluid with a rank odor, through a very small perforation on the posterior margin. There was slight tenderness of the mastoid on this side, no edema and rather prominent enlargement of the cervical glands below. The right side was normal, as were the nose and throat. The general physical examination gave negative results, except that the patient was very emaciated.

On April 23, 1926, roentgenograms of the mastoids showed that the very early cell structure of the right side was normal, while the cells in the left side were indistinct and hazy, if perceptible. The roentgen-ray diagnosis was chronic mastoiditis on the left.

On April 24, the white blood cells numbered 20,000; the temperature was 100.5 F. A simple mastoidectomy was performed, and a fairly well developed mastoid space was found filled with dark red granulations. There was no cell structure; the granulations were bathed in greenish yellow pus, which was pooled in a tip cell and poured from the mastoid antrum. Culture at operation was negative, but a special medium was not requested.

On April 27, when the dressing was changed, considerable secretion was observed, and the wound was surrounded by an inch wide zone of dark red reaction. The temperature was fluctuating between 98.6 and 100.5 F. The child complained unusually of pain in the wound.

May 1: The dressing was changed daily, but the wound was not healing properly. The granulations were covered with mottled white material and a glary secretion. Culture was made for the Klebs-Löeffler orgnism.

On May 2, the culture was positive for diphtheria. The patient was given 10,000 units of diphtheria antitoxin, intramuscularly. A guinea-pig was inoculated with 0.5 cc. of the twenty-four hour culture in saline, as a virulence test.

On May 3, the guinea-pig inoculated with the organism was dead at the end of thirty-six hours.

May 10: The wound was dressed daily, filled in rapidly and healed. Two successive negative cultures were obtained from the wound and from the nasal pharynx of the mother, father and infant brother.

June 15: Five weeks later the child had gained 12 pounds (5.4 Kg.), her color was good, her appetite had returned, and the nervous irritability had disappeared.

The appearance of necrosis in the mastoid was that of a long standing process. At no time in this long course did the child complain of earache, show any change in the ear drums or any lesion in the throat other than occasional redness.

Case 2.—Orvis, M., an infant, aged 13 months, was admitted to the hospital with both ears discharging and a swelling behind the left ear which had been present one week, following a bilateral otitis of two weeks' duration. There was no loss of appetite, and diarrhea was not present. The family history was negative, and no history of exposure to infectious disease could be made out. The results of physical examination were negative. There was a moderate cervical adenopathy; the temperature was 100.5 F. and the white blood cell count was 26,000. There were 71 per cent of neutrophils, 27 per cent of lymphocites and 12 per cent of large mononuclears. Urinalysis was negative. The left ear canal was swollen shut and draining profusely. The auricle stood forward from a typical mastoid edema. The right drum was draining inadequately, and was reincised. A simple mastoidectomy on the left side revealed a large subperiosteal abscess; the aditus antrum was filled with dark red granulation tissue and pus.

The patient was discharged on the ninth postoperative day at the demand of the parents, with a temperature of 99.6 F.

Second admission, June 8, 1926: The patient was returned by the parents because the mastoid wound would not close. It showed a deep crater, covered with dirty mucous secretion. This was packed daily with 2 per cent mercurochrome gauze and subjected daily to quartz lamp exposures. The temperature fluctuated between 98.6 and 100.5 F. The child's condition remained good, and the appetite was good. The appearance of the wound improved, and he was discharged after fourteen days, to be followed in the clinic. The right ear had been discharging at intervals.

Third admission, July 19: The patient, readmitted, was fretful and refused feedings; his temperature was 101 F., and the white blood cell count was 18,000. Examination of the mastoid wound showed the crater filled with a white, scar-like mass of tissue and a thin glary secretion of rancid odor. A zone of 2 inches around the wound was of a bluish cast and indurated; the edge of the granulations shared this color. The edges of the membranous deposit bled freely on tearing. Culture of the wound and of the secretion of the right ear was positive for diphtheria; 5,000 units of diphtheria antitoxin was given intravenously. Twenty-four hour cultures were toxic to guinea-pigs, which died within twenty-six hours; they showed subcutaneous edema and hemorrhage in the cortex of the kidneys. The temperature of the patient became normal in twenty-four hours, and the wound healed rapidly. Cultures became negative on July 31, eleven days after antitoxin treatment. Culture of the discharge from the right ear was positive at this date, but the organism was nonvirulent, the guinea-pig being alive at the end of five days.

August 13: The right mastoid was opened on this date; there was complete erosion of all structures, the mastoid antrum being full of fetid soft granulation tissue. Culture of this material showed a nonvirulent Klebs-Löffler organism which persisted for nine days. Antitoxin was not used locally in the ears.

It is to be noted that the infection in this patient with an active virulent organism, which it is reasonable to assume was present from the onset and not recognized, did not overwhelm the patient, and he was not extremely toxic at any time. The only thing suggestive of diphtheria was the failure of the wound to close, and profuse wound secretion, but this was overlooked until the third admission to the hospital.

It is interesting to observe the change in virulence in the diphtheria organism recovered from the right ear, which became nonvirulent eleven days after antitoxin treatment.

CONCLUSIONS

1. The symptomatology of diphtheria of the middle ear is so atypical that it probably accounts for the conviction that it is a rare occurrence. A contributory fact is that although almost every surgeon sends out a swab of the wound for culture at operation, it is not grown on special media unless requested.

2. The extent of destruction in the middle ear and mastoid is much greater than the severity of symptoms would indicate.

3. The classification of the strain of Klebs-Löffler organism as to virulence depends on the biologic test of guinea-pig inoculation.

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STUTTERING

THE CAUSE AND THE CURE

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Stuttering is more prevalent than is ordinarily supposed. The statistics obtained are lower than the actual incidence because a great many sufferers, believing either that they are incurable or that they will "outgrow" the condition, do not apply for treatment. It has been estimated that from 2 to 5 per cent of the school children in the entire United States are suffering from a definite speech defect, and that about 1 per cent of these are stutterers. That means that there are more than 200,000 children in the United States who stutter. To estimate the number of adult stutterers is impossible, for there is no way of obtaining the statistics. However, these figures are sufficiently large to indicate the seriousness of this speech defect.

1. DEFINITION

There is much controversy as to the exact meaning of stuttering. Some authorities do not differentiate between stuttering and stammering. Among those who do, there is little agreement. For ordinary purposes, the clearest distinction is to define stuttering as difficult speech, and stammering as incorrect speech or mispronunciation. This difference follows the German classification, which defines stuttering as "stottern" and stammering as "stammeln."

The common conception of these defects is that which really belongs under the category of stuttering, that is, that form of speech disorder in which there is difficulty in pronouncing certain sounds with a resultant repetition, as c-c-c-c-cat or ah-ah-ah-ah. At times there may be an inability to speak at all or to respond when spoken to suddenly. The stutterer can speak correctly, when he speaks at all. There is no mispronunciation as evidenced by his ability to sing and talk to himself. The trouble lies in the fact that he finds any kind of speech difficult.

2. ETIOLOGY

The cause of stuttering is a moot question. Makuen believes that heredity is the most important factor, and it is undoubtedly true that stuttering is found in succeeding generations in families. Great care must be taken, however, to distinguish between what is imitation from contact and

what is due to a neuropathic taint. Blume holds that the most immediate cause is a brain that is working too fast for the undeveloped articulatory organs to express the thoughts conceived. This cause is much the same as that of cluttering, which is nothing more than mental haste. The two may be combined, but they are not the same disturbance. Cluttering is due to haste; stuttering, to fear. The clutterer speaks more clearly the more he concentrates on speech, whereas the stutterer becomes more indistinct because he is already overanxious and conscious of his handicap.

Schmalz attributes stuttering to a cramp of the vocal cords, and certainly there is a spasmodic contraction of the cords, but this is an effect, not a cause. Gutzman considers temperament the chief cause. Others believe that the condition is of psychic origin. When one speaks of temperament and psychic origin as causes, one is getting close to the truth, for in my opinion stuttering is a spastic coordination neurosis caused by a mental conflict.

Whatever other contributory causes there may be in the etiology of stuttering, the most important are a predisposing cause in the form of a neuropathic constitution and an exciting cause in the form of a nervous shock or psychic insult. The underlying predisposition is to be attributed to the heredity. The shock may come from a fall, an operation, nervous exhaustion following the exanthematous diseases or severe acute infections, or from fear, embarrassment, anxiety, a frightful experience or the psychoneuroses.

A girl began to stutter after her life had been threatened with a stiletto. A boy began to stutter when suddenly and abruptly called on to recite in the classroom. Another little boy found himself speechless after being told a gruesome ghost story by his brother while they were alone in bed at night; on regaining speech, he stuttered.

DIAGNOSIS

The diagnosis is self evident. A stutterer betrays himself as soon as he speaks. Among the most common sounds that the stutterer is likely to falter are *p*, *b*, *m* and *w*. Test phrases may be employed to determine the extent and severity of the disorder. However, it should be remembered that a stutterer does not always stutter on the same sounds. Furthermore, the character of the defect depends on the emotional state of the stutterer during the examination. The following test phrases may be used in examining for stutterers.

1. I want to learn to speak correctly.
2. Electricity.
3. Hippodrome.
4. Hippopotamus.
5. The hippopotamus in the hippodrome.

6. Water, water everywhere.
7. Merry maids merrily singing.
8. Bye, bye, baby boy.
9. Sewing shirts for soldiers.
10. Third riding artillery brigade.

METHODS OF TREATMENT

The treatment of stuttering is a difficult and a tedious task, requiring great patience both on the part of the patient and on the part of the physician in charge. The patient must be told at the outset that the situation is difficult; that a cure is possible, but that there must be faith and diligence; that the process is slow, and that improvement at the end of six months is a favorable omen. Furthermore, no case should be undertaken unless the patient is willing to be treated for a period of not less than one year at intervals of at least twice a week. When this has been made clear, one may proceed with the actual treatment, which may be considered under three headings: surgical, psychotherapeutic and reeducational.

Surgical Treatment.—Although, primarily, stuttering is a mental affliction, there are physical factors that may be associated and act as aggravators. These are adenoids, abnormal length and thickness of the uvula, abnormal size and tumors of the tongue, hemiatrophy of the tongue, cleft palate, harelip, deformities of the jaw, improper development of the palatal arch, imperfect dental arches, nasal polypi, hypertrophied turbinates, marked deviation of the septum, tongue tie and defective hearing. These conditions require the services of the rhinolaryngologist, oral surgeon or orthodontist.

Psychotherapeutic Treatment.—Stuttering has been defined as a spastic coordination neurosis based on a mental conflict. To determine the nature of this mental conflict, which has long since been forgotten and lies buried in the subconscious mind, hypnosis or psychanalysis may be employed. The nature of the conflict is discovered and revealed to the stutterer. The stored up and suppressed emotions are liberated, and through analysis and discussion a readjustment is established. Suggestion is also useful in creating a spirit of self-confidence, something the stutterer usually lacks. By positive suggestion the stutterer is convinced that he can speak, that he is cured and that he is well.

Another form of psychotherapy that can be used to advantage is distraction. The attention of the stutterer is focused on his speech. This attention can be distracted by various means, such as the metronome, the megaphone, singing or chanting, elongation of the vowels, pacing, writing, change of voice and breath-grouping.

The Metronome.—The metronome should be regulated to a slow beat, and the stutterer should utter one syllable to the beat. This takes

away his attention from his speech and concentrates it on the beating of the metronome. As a consequence, he does not stutter. The rate of the metronome may be increased as the patient gains confidence.

The Megaphone.—The patient should repeat a sentence. If he stutters saying it, he should be made to repeat it through a megaphone, at the same time raising his voice as if he is going to shout. The fact that he is using the megaphone is a distraction sufficient to overcome the stuttering. He should then be told that he really can talk well, that it is only a matter of introspection, and that lack of will and confidence prevent him from doing so.

Singing and Chanting.—Stutterers have no difficulty in singing. They enunciate clearly and correctly. This is because singing acts as a distraction. Chanting a sentence on which he has stuttered will demonstrate to the patient that there is no physical articulatory disturbance.

Elongation of Vowels.—A common method in overcoming stuttering is to have the patient elongate all the vowels, as, "Theeeee meeeen wooork fooor mooooneeeey." The period of elongation is then reduced, until normal speech without stuttering is possible. Care must be taken that the patient is not trained to a false and artificial method of talking.

Pacing and Writing.—The stutterer is told to pace the room in even strides, pronouncing one word at each stride. The act of walking causes distraction, and the stuttering disappears. Similarly, he is told to make a straight line for each syllable he pronounces, and it will be noted that he does not stutter as he speaks while writing. The writing acts as a distraction.

Change of Voice.—If the patient is told to whisper one word, raise his voice on the next, lower it on the third and shout on the fourth, he will not stutter. The change of volume keeps his attention fixed; he forgets himself and consequently speaks correctly.

Breath Grouping.—Breath grouping is a simple, interesting and beneficial exercise. The patient is given a paragraph to read and is instructed to take the first word on the first breath, the next two words on the second breath, the next three words on the third breath, the next four words on the fourth breath and perhaps a whole sentence on the following breath. The number of words on a single breath may be changed to suit the ability and progress of the subject.

Reeducation.—Reeducation treatment, which is of great importance, is best conducted by a specially trained teacher under the supervision of a medical speech specialist. I classify this course of treatment under four headings: (1) relaxation, (2) breathing, (3) vocal gymnastics and (4) phonetics.

Relaxation: When the stutterer begins to speak, he directs his attention to the process and becomes tense. The muscles contract, he stands

rigid, the abdominal wall hardens like a board, the jaw is held tight, the lips are firmly compressed, the fists are clenched, the cheek muscles are taut and there is a spasm of the laryngeal muscles. Against this barrier of spasticity he throws a flow of speech which comes in a torrent of explosive utterances. The failure aggravates the situation, and he may become speechless.

The first task is to break down the wall of spasticity and liberate the imprisoned voice. The muscles of the face, mouth, neck, larynx, abdomen and, in short, of the whole body, for one speaks with the entire body, should be relaxed. To attempt reeducation in classes in which the children are told to sit at attention with their hands behind their backs or clenched tightly in a stiff position on the desk or lap, is an absurdity and is productive of more disaster than good.

The first requisite for relaxation is a sympathetic relationship between the patient and the physician. If the stutterer is afraid or in awe, the nervous tension is increased and cure becomes impossible. It is therefore of paramount importance to gain the confidence of the patient before treatment is attempted. This is not unlike the procedure in other forms of psychotherapy. Faith is half the cure. Nothing can be done with an unwilling patient. Speech reeducation is a matter of cooperation.

When harmony has been established, the attention is focused on the behavior of the patient. He must be made to feel thoroughly at home. He must forget that others are watching him. This is often difficult to accomplish, and many, if not most, of these persons cannot be treated in classes but need private attention. Whether in the classroom or in the private office, efforts should be directed toward making the subject forget his own existence. The best way to make the patient lose self-consciousness is to distract his attention. For this purpose the following relaxation exercises have been devised. Relaxation of the body as a whole may be obtained by the following exercises:

1. Sit in chair. Close eyes.
2. Relax and contract muscles of right arm, 1-2, 1-2, 1-2, 1-2, 1-2.
3. Relax and contract muscles of left arm, 1-2, 1-2, 1-2, 1-2, 1-2.
4. Relax and contract muscles of both arms, 1-2, 1-2, 1-2, 1-2, 1-2.
5. Relax and contract muscles of right leg, 1-2, 1-2, 1-2, 1-2, 1-2.
6. Relax and contract muscles of the left leg, 1-2, 1-2, 1-2, 1-2, 1-2.
7. Relax every muscle in the body, 1-2-3-4-5-6-7-8-9-10.
8. Rest for two minutes in relaxed position.
9. Sit up, eyes closed.
10. Drop head forward slowly until the chin rests on the chest for a count of five. Ready, 1-2-3-4-5.
11. Head on chest, bend slowly forward until the head almost rests on the lap through a count of ten. Ready, 1-2-3-4-5-6-7-8-9-10.
12. Gradually straighten back through a count of ten. Ready, 1-2-3-4-5-6-7-8-9-10.

13. Slowly raise the head through a count of five. Ready, 1-2-3-4-5.
14. Repeat exercises 10, 11, 12, 13 and 14 five times.
15. Open eyes.

The following exercises may be used for relaxation of posture:

1. Stand, left foot slightly forward, weight of body on right foot.
2. Raise and stretch arms high over head, body rising on toes, and yawn. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.
3. Put right foot forward and body weight on left foot.
4. Raise arms as before and yawn. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.
5. Walk up and down the room, body erect and steps of even length. Ready, 1-2, 1-2, 1-2, 1-2, 1-2, 1-2,1-2, 1-2, 1-2, 1-2, 1-2.

The following exercises may be used for relaxation of the head and neck:

1. Drop head forward, permitting chin to rest on chest, then return to position. 1-2, 1-2, 1-2, 1-2, 1-2.
2. Drop head backward as far as it can go, then return to position. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.
3. Drop head over right shoulder, then return to position. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.
4. Drop head over left shoulder, then return to position. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.
5. Roll head around: forward, right shoulder, back, left shoulder, forward, position. Ready, 1-2-3-4-5-6.
6. Roll head around in opposite direction: forward, left shoulder, forward, right shoulder, forward, position. Ready, 1-2-3-4-5-6.

These exercises may be used for relaxation of the arms:

1. Swing right arm forward so that it is parallel to the floor and at right angles to the body. Clench fist tightly for a count of 1-2-3-4-5. Relax muscles and drop arm to side and let it remain completely relaxed for a count of 1-2-3-4-5. Raise, 1-2-3-4-5. Drop, 1-2-3-4-5.
2. Repeat.
3. Use left arm instead of right.
4. Repeat.
5. Use both arms together.
6. Repeat.

These exercises may be used for relaxation of the hands:

1. Swing right arm forward, so that it is parallel to the floor.
2. Shake hand sideways. Ready, 1-2-3-4-5, 1-2-3-4-5.
3. Shake hands up and down. Ready, 1-2-3-4-5, 1-2-3-4-5.
4. Swing left arm, forward.
5. Shake hand sideways. Ready, 1-2-3-4-5, 1-2-3-4-5.
6. Shake hand up and down. Ready, 1-2-3-4-5, 1-2-3-4-5.
7. Both arms, forward.
8. Shake both hands sideways. Ready, 1-2-3-4-5, 1-2-3-4-5.
9. Shake both hands up and down. Ready, 1-2-3-4-5, 1-2-3-4-5.
10. Position.

These exercises may be used for relaxation of the tongue:

1. Let the tongue hang loosely and relaxed from the mouth for a count of five. Ready, 1-2-3-4-5.
2. Repeat, saying, la-la; la-la; la-la; la-la. Ready, la-la; la-la; la-la; la-la; la-la.
3. Repeat, saying, la-la-la; la-la-la. Ready, la-la-la; la-la-la; la-la-la; la-la-la; la-la-la.
   Note: The la, la, la should be said sleepily, each group more softly than the preceding one until the last is scarcely audible.
4. Repeat la-la-lively; la-la-lively, the voice being raised on "lively." Ready, la-la-lively; la-la-lively; la-la-lively; la-la-lively; la-la-lively.

These exercises may be used for relaxation of the larynx and vocal cords:

1. Open mouth, inhale air and exhale easily five times. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.
2. Sleepily, dropping head forward, say a. Ready, a-a-a-a-a.
3. Sleepily, dropping head forward, say e. Ready, e-e-e-e-e.
4. Sleepily, dropping forward, say i. Ready, i-i-i-i-i.
5. Sleepily, dropping head forward, say o. Ready, o-o-o-o-o.
6. Sleepily, dropping head forward, say u. Ready, u-u-u-u-u.
7. Softly sing up the scale a. Ready, a-a-a-a-a-a-a-a.
8. Softly sing up the scale e. Ready, e-e-e-e-e-e-e-e.
9. Softly sing up the scale i. Ready, i-i-i-i-i-i-i-i.
10. Softly sing up the scale o. Ready, o-o-o-o-o-o-o-o.
11. Softly sing up the scale u. Ready, u-u-u-u-u-u-u-u.

Breathing: Stutterers may or may not breath properly and defective breathing engenders stuttering, but the fact remains that stuttering nearly always causes wrong habits of breathing during speech. The chest may be violently heaved and pressed down, and the action of the diaphragm may be upward instead of downward, or attempts may be made to draw in air while the aperture of the larynx is either closed or narrowed, and even while the mouth passage is obstructed by the position of the tongue. Another bad habit is to talk while inhaling. If a large group of stutterers is closely studied, it will be observed that the majority of them have the clavicular and not the artistic form of breathing, that the action of the chest is laborious and that the natural emission of speech is checked by spasmodic closure of the mouth and glottis, or reversed by attempts to speak with the ingoing air. Because of this close association of incorrect breathing and stuttering, the following exercises have been devised, the practice of which will be of material value in obtaining a cure.

1. Stand erect, shoulders back.
2. Inhale through the nose and exhale through the mouth for a count of ten. Ready, inhale, 1-2-3-4-5-6-7-8-9-10; exhale, 1-2-3-4-5-6-7-8-9-10.
3. Inhale as before but exhale through the mouth in a whispering sound ah. Ready, inhale, 1-2-3-4-5-6-7-8-9-10; exhale, ah-ah-ah-ah-ah-ah-ah-ah-ah-ah.

4. Inhale as before but now exhale on the vowel a for a count of ten. Ready, inhale, 1-2-3-4-5-6-7-8-9-10; exhale, a-a-a-a-a-a-a-a-a-a.
5. Inhale as before but exhale on the vowel e for a count of ten. Ready, inhale, 1-2-3-4-5-6-7-8-9-10; exhale, e-e-e-e-e-e-e-e-e-e.
6. Inhale as before but exhale on the vowel i for a count of ten. Ready, inhale, 1-2-3-4-5-6-7-8-9-10; exhale, i-i-i-i-i-i-i-i-i-i.
7. Inhale as before but exhale on the vowel o for a count of ten. Ready, inhale, 1-2-3-4-5-6-7-8-9-10; exhale, o-o-o-o-o-o-o-o-o-o.
8. Inhale as before but exhale on the vowel u for a count of ten. Ready, inhale, 1-2-3-4-5-6-7-8-9-10; exhale, u-u-u-u-u-u-u-u-u-u.
9. Keep head up, shoulders back, mouth closed.
10. Inhale through two strides and exhale through two strides. Ready, inhale, 1-2; exhale, 1-2; inhale, 1-2; exhale, 1-2; inhale, 1-2; exhale, 1-2; inhale, 1-2; exhale, 1-2.
11. Inhale through three strides and exhale through three strides. Ready, inhale, 1-2-3; exhale, 1-2-3; inhale, 1-2-3; exhale, 1-2-3; inhale, 1-2-3; exhale, 1-2-3; inhale, 1-2-3; exhale, 1-2-3; inhale, 1-2-3; exhale, 1-2-3.
12. Keep on increasing the number of strides until it becomes an effort.
13. Attention. Breathe normally.
14. Read in a strong, loud whisper. Stop as soon as giddy.

Vocal Gymnastics: Though stuttering is a neurosis and is not caused by improperly functioning articulators, it is often associated with a physiologic disorder of these organs. The lips are spastic, the tongue is rigid, the soft palate is stiff and the muscles of the mouth and throat are taut. Consequently, not infrequently a secondary improper articulation is developed on top of the inability to speak. The following exercises have been devised to overcome the disorders of the articulatory organs.

These exercises may be used for tongue gymnastics:

1. Push the tongue outward and downward toward the chin out of the mouth. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.
2. Push the tongue outward and upward toward the nose, out of the mouth, as far as possible, even touching the nose. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.
3. Point the tip of the tongue upward and downward alternately. Ready, 1-2-3-4-5-6-7-8-9-10.
4. Rotate the tongue to the right, then down, then to the left, then up, then to position. Ready, 1-2-3-4-5; 1-2-3-4-5; 1-2-3-4-5; 1-2-3-4-5.
5. Protrude the tongue, grooving it at the same time by raising both sides. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.
6. Curl the tip of the tongue back of the front teeth with the mouth kept open. 1-2, 1-2, 1-2, 1-2, 1-2.
7. Press the tip of the tongue back of the front lower teeth. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.

These exercises may be used for lip gymnastics:

1. Protrude the lips in a puckered condition. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.
2. Raise the upper lip, exposing the teeth. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.
3. Wrinkle the nose so as to expose the upper teeth. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.

4. Raise the right side of the upper lip. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.
5. Raise the left side of the upper lip. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.
6. Pull down the lower lip, exposing the lower teeth. Ready, 1-2, 1-2, 1-2, 1-2, 1-2.

These exercises may be used for gymnastics of the soft palate:

1. With mouth wide open, say ah-ah-ah and watch the palate rise. Ready, ah-ah-ah-ah-ah-ah-ah-ah-ah-ah.
2. Yawn and watch the palate rise. Ready, yawn.

Phonetics: Though there is no primary phonetic disorder in stuttering, bad speech habits are formed which require reeducation. Furthermore, the stutterer is more likely to stutter on certain sounds than on others. The most common of these are *p, b, m* and *w*. The following phonetic exercises are especially designed for the teaching of the proper pronunciation of these sounds.

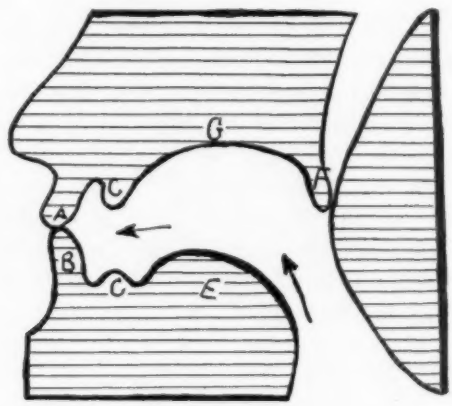

Fig. 1.—Production of the p sound: The lips are together, blocking the oral outlet, and the uvula closes the nasopharyngeal space; a current of air is allowed to gather behind the lips and then is expelled in a sudden puff against the lips. *A* indicates the upper lip; *B*, the lower lip; *C*, the dental arch; *E*, the tongue, and *F*, the uvula.

THE P SOUND

Production

1. Place the lips together, blocking the oral outlet.
2. Allow a current of air to gather behind the lips.
3. Expel this current in a sudden puff against the lips and between them.

Technic

Hold a strip of paper in front of the mouth to get the current of air.

Sound Drill

pah	pee	poh
pa	paw	poo

Word drill

Inital P	Middle P	Final P
pin	paper	lip
pun	dapper	snap
paddle	wrapper	lap
padding	spry	wrap
Peter	stopper	flop

Sentence Drill

1. Hippopotamus in the hippodrome.
2. Peter Piper picked a peck of peppers.
3. Polly paid for the pears and peaches.
4. Put the pictures on the paper.
5. The pirate purchased pearls and opals.

Rhyme Drill

Peter, Peter, pumpkin eater,
Had a wife and couldn't keep her;
He put her in a pumpkin shell
And there he kept her very well.

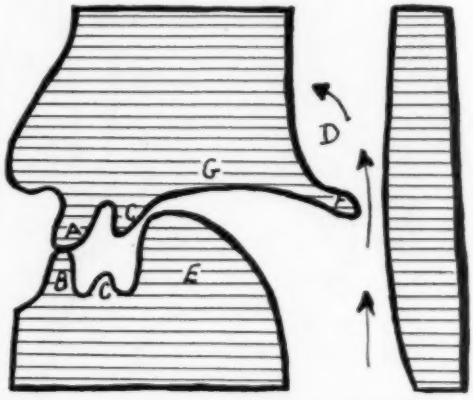

Fig. 2.—Production of the m sound: *A* indicates the upper lip; *B*, the lower lip; *C*, the dental arch; *D*, the nasopharyngeal space; *E*, the tongue; *F*, the uvula, and *G*, the palate. The lips are together, which blocks the oral outlet; the nasopharyngeal space is wide open, the tip of the tongue is elevated, and the sound is forced out through the nose.

THE B SOUND

Production

The production of the *b* sound is similar to that of the *p*. The articulatory surfaces are in the same position. The lips are placed together and the oral outlet is blocked. The only difference is that the current of air that is gathered behind the lips and then expelled in a sudden puff between the lips is vocalized.

Technic

A vibration should be felt in the throat. There was none for *p*. The lips must be opened quickly for the *b* sound.

Sound Drill

bah	bee	boh
ba	baw	boo

Word Drill

Initial B	Middle B	Final B
bear	rubber	scrub
bud	robber	rib
bed	obey	tub
blister	about	grub
batter	fable	stub

Sentence Drill

1. Billy's brother bought a bat.
2. Bye, bye, baby boy.
3. Butter the bread and boil the beans.
4. Beauty and the beast, side by side.
5. Break, break, break, at the foot of the rocks, O sea.

THE M SOUND

Production

1. Place the lips together, blocking the oral outlet.
2. Force the sound out through the nose.

Technic

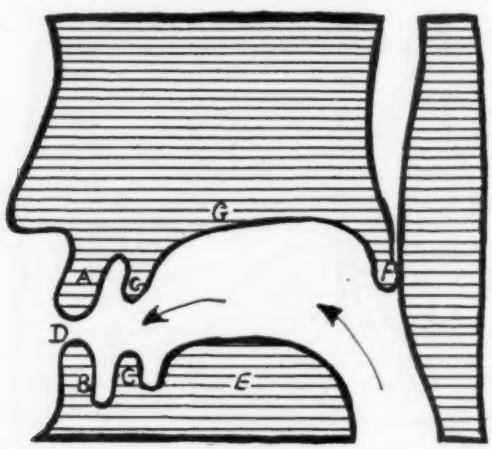

Fig. 3.—Production of the w sound: *A* indicates the upper lip; *B*, the lower lip; *C*, the dental arch; *D*, the aperture; *E*, the tongue; *F*, the uvula, and *G*, the palate. The lips are pushed forward, making a small aperture between them; the nasopharyngeal space is closed by the uvula, a current of vocalized breath is allowed to gather behind the aperture and then is expelled through it.

Stutterers make the lips tense. There should be no pressure between the lips. Place a strip of paper between the lips and allow the lips to close on it gently, then make the sound without any labial tension.

Sound Drill

Vary the following, using them singly, repeatedly or in combinations.

mah	me	moh
ma	maw	moo

Word Drill

Initial M	Middle M	Final M
mind	summer	sum
mud	amid	rim
mare	mama	boom
muff	farmer	cram
Mary	drummer	dam

Sentence Drill

1. Many men marching.
2. May and Mary made marmalade.
3. Merry maids of Marvin, merrily singing.
4. Men make more money.
5. Miss Martin and the master marveled at the mountain.

THE W SOUND

Production

1. Push the lips forward, making a small opening between them.
2. Allow a current of vocalized air to gather behind this aperture.
3. Expel the vocalized air through this aperture.

Sound Drill

wah	wee	woh
wa	waw	woo

Word Drill

Initial W	Middle W
wife	sway
while	away
waste	swoon
water	everywhere
wood	erstwhile

Sentence Drill

1. William wants water from the well.
2. In the wild and wooly west the wild men live.
3. Wilfred walked to the west.
4. Whether we want or whether we don't, we have to work.
5. Blowing winds make winter weather.

Rhyme Drill

Water, water, everywhere,
And all the boards did shrink;
Water, water, everywhere,
Nor any drop to drink.

SUMMARY

Stuttering is a spastic coordination neurosis based on a mental conflict.

The causes are a predisposing neuropathic constitution and an exciting factor in the form of a nervous shock or psychic insult.

The treatment is threefold: surgical, psychotherapeutic and reeducational.

The surgical treatment is directed toward the correction or removal of abnormal physical conditions in the vocal passages.

Psychotherapy, in the form of hypnosis, psychanalysis, autosuggestion, heterosuggestion and distraction, is directed toward unearthing the basic mental conflict and readjusting the personality.

The reeducational treatment consists of a series of exercises under four different headings: relaxation, breathing, vocal gymnastics and phonetics.

Stuttering is a curable condition, but it requires the combined efforts of the patient, the teacher and the physician to cure it.

365 West End Avenue.

OSTEOMA OF THE FRONTAL, THE MAXILLARY AND THE SPHENOID SINUSES

WITH REPORT OF CASES *

W. T. GARRETTSON, M.D., F.R.C.S.
DETROIT

In a discussion of osteoma of the frontal sinus, many things are to be considered. Because of its comparative rarity, the theories concerning the origin and the incidences of osteoma of the frontal sinus as compared with other tumors must be considered first.

INCIDENCE

Statistics on the incidence are so variable that an accurate estimate can be only approximate. In general, about 215 cases of either a single osteoma or a multiple osteoma have been reported from all sources during the last 175 years. Hermann Knapp [1] found four osteomas of the orbit which had their origin in the paranasal sinus in 56,000 cases. Then he noted that this tumor occurred more frequently in the floor of the frontal sinus than in any of the paranasal sinuses. Andrews compiled eight cases of osteoma of the orbit in 430,000 cases of eye disease. Bornhaupt [2] reviewed the literature and compiled twenty-three cases of osteoma of the orbit which originated in the frontal sinus and twenty-six others of osteoma of the orbit which originated in contiguous sinuses. He regarded them as originating at the junction between the frontal and the ethmoid bones in cartilaginous rests. Arnold [3] also regarded these tumors as originating in cartilaginous rests. His opinion was based on this fact since the ethmoid bone is developed in cartilage and the frontal bone in membrane. Development of cartilaginous rests may easily occur at their line of union.

In actual cases, however, the point of origin appears to be well removed from this junction, and is usually in the floor of the frontal sinus. This, I think, is sufficient to disprove the theory of Arnold. Further, the fact that no cartilaginous débris has ever been found in the region of the junction also would lend more evidence to disprove the aforementioned theory. Virchow [4] believed that the origin was from the diploe of the frontal bone; Dalbeau believed that it was an ossification of the schneiderian membrane which lines the nasal cavities; Sappey

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* From the Department of Ophthalmology and Otolaryngology of the Henry Ford Hospital.

1. Knapp, J. H.: Arch. f. Ophth. **8**:239.
2. Bornhaupt: Arch. f. klin. Chir. Berl. **36**:589, 1881.
3. Arnold: Virchows Arch. f. path. Anat. **57**:145.
4. Virchow: Die Krankhaften Geschwülste. 1865.

believed that their origin was from the periosteum lining the sinus; Von Rokitansky [5] believed that they were enchondroma which had ossified.

Age Incidence.—Cases are on record in which osteomas have occurred in persons between the ages of 4 and 74 years. However, more than 50 per cent occurred during adolescence, and about 30 per cent before 30 years of age. In general, however, these tumors develop in the young when the bones are undergoing the greatest developmental activity.

CHARACTERISTICS

The varieties of osteoma are as follows: (1) hard, eburnated; (2) compact, and (3) spongy. They vary in size from that of a bean to that of a good sized potato. The weight varies from 7 to 440 Gm. A tumor in one of Hilton's patients weighed 14¼ ounces (403 Gm.). This tumor was an osteoma of sphenoid origin and was the largest one on record. The hardened and eburnated variety, owing to their extreme hardness, are difficult to remove or to make even an impression on with saw, chisel or other instrument that may be used. In many of the other cases reported, an operation had to be abandoned owing to fear of fracturing the skull.

GROWTH

Growth usually is slow; it is often ten years or more before the tumor causes the patient to seek relief. There may be several tumors and they may involve even the frontal nasal or lacrimal bones or all of them combined.

PATHOLOGY

These tumors are more or less encapsulated, usually with an eburnated outer coating or bony capsule which surrounds a more or less cancellous center. The haversian canals and lucanae when present are irregular in both form and arrangement. In most of these cases, there is usually a pedicle which joins the tumor to some part of the sinus; in the case of the frontal sinus, the tumor is usually attached to the floor. The pedicle is cancellous in structure. There are cases on record in which this pedicle has become detached, giving rise to the so-called "dead osteoma" which is occasionally found in cadavers. When detached, these tumors become freely movable and form more or less of a foreign body. The surface of the tumor is ivory-like in the eburnated variety, irregular and takes shape and form from the confining walls. The covering is of connective tissue. The mucosa which covers the projecting tumor into the sinus cavity usually shows polypoid degeneration. If the nasofrontal duct is obstructed, mucocele is usually present.

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5. Von Rokitansky: Handbuch der Spezielle pathologische Anatomie, 1844.

SYMPTOMS

Symptoms may be divided into (1) local, that is, within the sinus itself, and (2) those from pressure on adjacent cavities.

(1) Patients often have attacks of pain over the site of the sinus or growth. This is usually caused by a growing tumor. In general, however, there are no symptoms, owing to the slow growth, unless basal structures are pressed on, and these usually are in the later stages when the nasofrontal duct has been closed and either mucocele or sinus infection is present, or when pressure on the nerve supply to the orbital tissue or under the optic nerve itself is present.

(2) The symptoms in the second class of cases depend on the cavity involved and on the extent of the encroachment. The older cases which are reported are principally cases of tumors of the orbit. The classic picture of this tumor is as follows: The orbital contents are displaced, usually forward, outward and downward, with a marked proptosis. In a tumor of this kind, palpation above the eye usually reveals a hard, firm ball which is more or less painful. The tumors within the nasal cavity or sinus often project into the brain cavity. Before the days of the roentgen ray, these were not recognized. Diplopia and optic nerve derangement are often prominent symptoms. In the intranasal type, external nasal deformities and nasal obstruction may be present. In those with prominence of intracranial extension in the place of sinus infection, meningitis may be the first symptom. However, the tumor may project into the cranial cavity, owing to the great adaptability of the brain to gradual encroachment from without.

DIAGNOSIS

Besides the clinical symptoms mentioned in the foregoing, roentgen-ray examination is of paramount importance, especially in the eburnated variety of tumor. In the compact or cancellous variety, the roentgen ray, aside from showing the bony tumor, does not give the classic picture owing to the similar roentgenographic density. In these kinds of tumors, malignant bone tumors will be rather difficult to differentiate. In the diagnosis, mucocele of the ethmoid and frontal and maxillary sinuses must be differentiated. In these, expansion of bone usually is present until the point is reached at which superadded infection may intervene. Malignant tumors are rare in the frontal and ethmoid sinus, but in the maxillary sinus bony tumors originating from the dental structures may render diagnosis difficult. The rareness of the osteoma, however, tends to eliminate the diagnosis of malignancy.

PROGNOSIS

In older statistics the prognosis was not good, owing to sepsis at the time of operation. Bornhaupt [2] found a mortality of 63 per cent in eleven cases in which operation had been performed. Most of these

were performed before the days of aseptic surgery. Hucklenbroich[6] reports statistics in cases in which operation had been performed between 1850 and 1874: twenty-eight cases with a mortality of 28.6 per cent; between 1870 and 1900, forty-six cases with death in three, or a mortality of 6.5 per cent; between 1900 and 1905, fifteen operations were performed, with no deaths. Since then, the statistics have not been compiled accurately.

TREATMENT

The treatment is complete surgical removal whenever possible. This usually is best accomplished by the external route after the method of Killian, whose frontal sinus operation is classic, and in this operation the ethmoids and sphenoidal osteoma may best be approached.

REPORT OF CASES

The following cases are illustrative:

CASE 1.—*History.*—A youth, aged 19, a driver, was admitted to the hospital on June 20, 1922, during my absence. Examination showed proptosis of the left eye with downward and outward displacement, a cloudy left antrum, a cloudy left frontal sinus, deflection of the septum to the left and chronic tonsillitis. There was slight hyperplasia of the thyroid. Urinalysis and Wassermann tests were negative.

The patient returned to see me on July 7, 1922. Roentgen-ray examinations had been made in the meanwhile. The left frontal sinus did not illuminate. There was marked proptosis of the left eye, with marked downward and outward displacement. Just above the eyeball at the roof of the orbit and on the floor of the frontal sinus, there was a hard mass which could be felt but on which no impression could be made by palpation. Examination of the roentenograms, both anteroposterior and lateral, showed the growth to be an osteoma, apparently extending from the floor of the frontal sinus into the ethmoid region, into the orbit and into the frontal sinus cavity. A lateral view showed that the tumor did not involve the sphenoid. There was some question in my mind, after looking at the roentgenograms, as to whether or not the roof of the frontal sinus was involved. I felt that a radical operation should be performed on the frontal sinus after the method of Killian, with complete exenteration of the ethmoid cells on this side and the removal of the tumor from the orbit and frontal sinus. The mother was advised that the boy should have this operation, which would cause considerable deformity; his appearance might be improved later by cartilage rib graft into the site of the depression. Before the tumor was examined, it was impossible to state definitely whether or not sight could be retained in the eye following operation. Judging from the evidence, the tumor was probably encapsulated, and could probably be removed without disturbing the nerve supply to the eye.

Operation and Course.—The patient was admitted for operation on July 13, 1922. I performed the operation; my assistants were Dr. E. L. Whitney and Dr. Bernard A. O'Hora. Incision was made in the supra-orbital ridge in the left eyebrow and extended down over the nasal bone to the inferior margin of the orbit. Periosteum was elevated over the line of incision. This was carried down to the tumor projecting into the orbit. Periosteum was elevated over the roof of the orbit extending down over the nasal bone and to the lacrimal bone and lacrimal sac. Secondary incision was made through the periosteum three-eighths of an inch above the incision through the skin covering the

6. Hucklenbroich: Inaug. Dis., Freiburg, T. B., Speyer and Kaerner, 1906.

ridge which was to be made later. This incision was carried past the midline instead of making a curve as in the original incision. The frontal sinus was entered by means of a gage and mallet. It was found to be filled completely with mucocele. The contents were removed, and a hard tumor mass was found projecting into the frontal sinus, obstructing completely the nasal frontal duct on that side. There was a large bony tumor in the orbit which extended through from the floor of the frontal sinus, and another extension filled almost the entire ethmoid labyrinth. The remaining ethmoid cells which were not occupied by tumor were filled by mucocele. Considerable difficulty was encountered in the complete

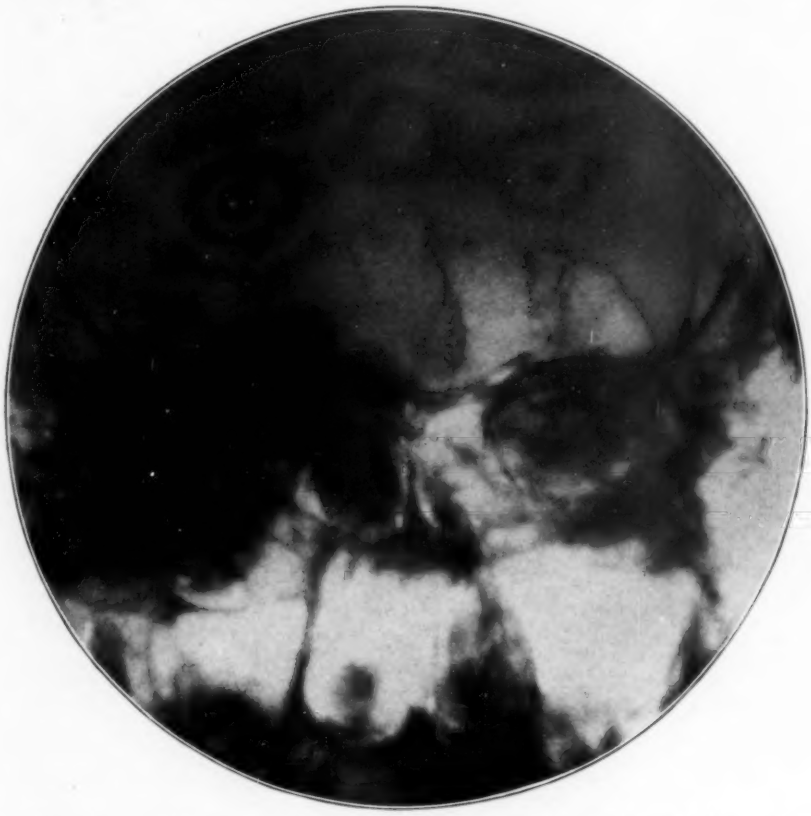

Fig. 1 (case 1).—Roentgenogram taken before operation on frontal sinus, showing osteoma from an anteroposterior view.

removal of the osteoma, as little impression could be made on it by means of the chisel for fear of fracturing the skull. However, after much effort and manipulation, the tumor was removed completely in the three situations mentioned in the foregoing—orbit, frontal sinus and ethmoid labyrinth. The frontal sinus on the opposite side was entered, and the septum was removed in order to provide an additional exit for discharge and drainage. The middle turbinate bone and the whole ethmoid labyrinth were removed completely. The eyeball was then put back in place, and no attempt was made to remove the lining membrane of the mucocele cavity of the remainder of the frontal sinus. The periosteum was sutured by means of interrupted catgut suture and subcutaneous tissues approximated with interrupted catgut, and the skin was closed by interrupted silk. A

small rubber dam drain was left in the frontal sinus, protruding through the nose, and one small drain was left at the angle of the wound. The skin was closed with interrupted silk stitches.

The postoperative course was uneventful. The patient was discharged from the hospital on the fourth day, and the stitches were removed on the fifth. He returned from time to time, and a note by Dr. Whitney, on August 21, 1922, about five weeks after operation, showed that there was practically no scarring or deformity in the region of the orbit. The eye was in normal position. The patient still had some diplopia in addition. He had symptoms of hay-fever. Roentgen-ray examinations of sinuses were made as a follow-up procedure, and

Fig. 2 (case 1).—Roentgenogram taken after operation.

these showed no evidence of osteoma. The patient was seen on Sept. 4, 1924, one and one-half years following the operation, and an examination made by me showed that the orbit and sinus were satisfactory. The left eye was reseated, and the patient saw normally. There was slight depression above the orbital ridge on the left but little scarring. The patient had had no symptoms following operation and no unusual nasal discharge. He seemed to be pleased with the result.

CASE 2.—*History.*—A woman, aged 61, was admitted to the hospital on Nov. 1. 1923, with the history of fracture of the thigh. The routine examination in the nose and throat showed marked proptosis of the left eye, with downward and outward displacement. Converging function of the left eye was impaired, but the pupil reacted to light and in accommodation. Vision for distance and proximity

was normal. Other than fracture of the hip, there was not anything unusual in the results of the general physical examination. Examination of the urine showed a faint trace of albumin. The Wassermann test was negative. Culture of the urine showed profuse growth of bacilli. The phthalein test showed 69 per cent in two hours.

Roentgen-ray examination of the skull showed that frontal, ethmoidal and maxillary sinuses were clear, but that there was a large area of density which involved part of the frontal bone posterior to the frontal sinus, apparently involving the posterior part of the superior maxillary sinus, extending into the sphenoids and posterior part of the frontal sinus, and apparently extending into the orbit

Fig. 3 (case 1).—Roentgenogram taken after operation for osteoma of the frontal sinus, showing lateral view.

through the sphenoid fissure. The lateral view was not satisfactory and showed practically the same extension. The impression was that an osteoma of the base of the skull, involved the sphenoid, frontal and superior maxillary sinuses. As the patient did not have symptoms referable to the osteoma, with the exception of occasional diplopia, and owing to the patient's fractured hip and age, it was thought inadvisable to operate.

Case 3.—*History.*—A man, aged 46, entered the hospital on Dec. 16, 1924, complaining of sinus trouble. General examination showed that the Wassermann test of the blood and the urinalysis were normal. Examination of the sinuses showed cloudy antrums with some pus coming from the right side. Roentgen-

ray examinations of the sinuses showed dense clouding of the right antrum. Puncture of the antrum was not possible, but on account of the marked clouding of the right antrum and the history, it was thought best to perform a radical operation on the right antrum under block anesthesia.

Operation and Course.—Incision was made above the gum line, and the antrum was entered with mallet and gage. The bone was extremely thick, and there appeared to be no antral cavity, but what ordinarily would be moderately spongy bone was cancellous osteoma. There seemed to be spaces in between the division,

Fig. 4 (case 1).—Eburnated osteoma from case of osteoma of frontal sinus.

Fig. 5 (case 1).—Osteoma of the sphenoidal sinus showing proptosis of the eye.

but there was no evident mucous membrane. The tumor evidently had arisen from the floor of the antrum and had grown upward, almost obliterating the cavity. No evidence of pus was present. The naso-antral wall of the inferior meatus was extremely thick and was reduced to the level of the floor of the nose. Free entry was possible. The natural ostium of the middle meatus was also enlarged. The incision was closed by means of interrupted silk stitches. Culture was taken.

The pathologic diagnosis was benign tumors of the antrum of the bone—osteoma. The specimen consisted of fragments of cancellous bone removed from the antrum. Microscopic sections showed bits of fibrous tissue and cancellous bone.

LYMPHOID TUMORS OF THE TONSIL

REPORT OF FOUR CASES *

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AND
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The great majority of new growths originating from the tonsils are malignant. There are comparatively few benign tumors of the tonsils; some types of these are so rare that each case is of great interest and worthy of being recorded. Fibromas and papillomas are the commonest types of benign tonsillar tumors; but besides these, lipomas, myxomas and cysts occasionally are encountered. Pure lymphoid neoplasms of the tonsils are among the rarest varieties of tonsillar growths; as far as we have been able to find, only a small number of cases of such tumors have been reported in the literature. We have been fortunate enough to obtain specimens in four cases of this kind, the histories of which are not available to us but the pathologic reports of which are appended.

The general literature on the subject of lymphoid tissues of the tonsils is limited.

In a thesis dealing with the various types of benign growths in the tonsil, written by Ardenne [1] in 1897, he states that there was only one case of lymphoid tumor—a cystic adenoma—reported in the literature up to that date.

A search through the literature, however, revealed a limited number of reports, a synopsis of which follows. Several of these were compiled by Bezdek.[2]

Froelich [3] reported a case in a man aged 40, who for many years had had difficulty in swallowing; he also had what was apparently a chronic pharyngitis, and both tonsils were hypertrophied. A small movable mass was depended by a thin pedicle from the middle of the right tonsil. A second mass extended from the arcus palatopharyngeus dexter and hung free in the pharyngeal space. On histologic examination, the first tumor was found to consist of true lymphoid tissue, the second tumor being a papilloma.

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1. These, Bordeaux, 1896; Rev. de laryngol. **17**:209, 1897.
2. Bezdek: Wien klin. Wchnschr. **17**:504, 1904.
3. Froelich: Inaug. Dissert., Göttingen, 1880.

Juracz [4] mentions a case proved histologically to be a pure lymphoid tissue tumor, which filled the whole isthmus faucium and depended by a small pedicle from the posterior palatine arch. Both tonsils were atrophied.

In Reinhard's case,[5] that of a youth, aged 16, the patient suffered from dysphagia and dyspnea for six months. Examination showed the left tonsil hypertrophied and a small mobile pedunculated tumor, which moved back and forth, implanted on this tonsil. The pedicle, 5 mm. in length, originated from the superoposterior part of the left tonsil. Microscopically, the tumor was described as a degenerated accessory tonsil.

In Frühwald's case,[6] a man, aged 43, had had a recurring inflammation of the throat with a recent history of attacks of suffocation. Examination showed the right tonsil much hypertrophied and a mass depending from it by a pedicle into the pharynx. Histologically, the tumor was composed of pure tonsillar tissue.

In Morgan's case [7] and in that of Ellerman,[8] cited by Bezdek, tonsillar tissue masses depended from the right side of the velum palatinum.

In Lamarcy's [9] and Claiborne's [10] patients, similar pendulous growths originated from the left tonsil, and in Bandler's [11] and Rethi's patients,[12] the tonsillar tissue mass hung from the posterior palatine arch. There were associated congenital palatal defects in both Claiborne's and Rethi's cases.

Bezdek [2] reports a growth with cervical pain and disturbance of deglutition in a girl, aged 16. The right tonsil was normal. The left tonsil was hypertrophied and traversed by dilated vessels; on this tonsil there was a pealike, hard tumor of the same color as the tonsil, but entirely isolated and movable on a pedicle. Histologically, the mass was atrophic tonsillar tissue. Bezdek cites a similar unreported case observed by Deutsch in a woman, aged 39. The tumor, which was yellowish, was attached by a pedicle from behind the right tonsil: histologically, it was composed of tonsillar tissue.

In Tanturri's [13] case in a woman aged 19, a tumor the size of a small nut, pinkish and smooth, depended by a short pedicle implanted in the left supratonsillar fossa. Neither the cervical nor the submaxillary

4. Juracz: Monatschr. f. Ohrenh. **19**:361, 1885.
5. Reinhard: Wien. klin. Wchnschr. **2**:373, 1899.
6. Frühwald, cited by Bezdek (footnote 2).
7. Morgan, cited by Bezdek (footnote 2).
8. Ellerman, cited by Bezdek (footnote 2).
9. Lamarch, cited by Bezdek (footnote 2).
10. Claiborne, cited by Bezdek (footnote 2).
11. Bandler, cited by Bezdek (footnote 2).
12. Rethi, cited by Bezdek (footnote 2).
13. Tanturri: Arch. ital. di laringol. **22**:69, 1902.

glands were swollen. Histologically, the tumor was a pure adenoma of the tonsil.

Renault and Cain [14] reported the case of a child, aged 7 years, who had an enormous swelling which developed at the expense of the right tonsil, and which occluded the pharynx. The tonsil itself was ulcerated, and the tumor was hard in consistency. The tumor simulated a true chancre; and, as the Wassermann reaction was partly positive, antisyphilitic treatment was instituted. The child died of cachexia and suffocation. Autopsy was not performed, but microscopic examination of a fragment of the tumor mass showed it was typical lymphadenoma of marked activity

Chaveaux [15] reported a case of histologically verified lymphoid mass the size of a kidney bean springing from the posterior wall of the pharynx and simulating a supplementary tonsil.

In the cases referred to in the foregoing, there can be little doubt that the tumor masses were distinct from the ordinary hypertrophied tonsil. Portmann [16] has called attention to another class of cases which he terms palatal tonsil adenoma, appearing in young children, in adolescents and even in adults. This condition occurs either in a healthy tonsil or after tonsillectomy. Portmann states that in 1908 Munch reported the first cases of this kind to the Societe française d'otorhinolaryngologie. The case occurred in a child, and Munch termed it acute recurring unilateral hypertrophy of the tonsils. The greatly enlarged left tonsil had to be removed to prevent suffocation. Tonsillectomy had been performed on the same side five years previously. This was not a simple inflammation with recurrence, but a hyperplasia of the tonsil tissue.

In 1913, Moure reported some similar cases in children whose tonsils had been removed previously. Moure thought hyperplasia is brought about by some exciting cause, such as a cold; the acute attack subsides after a while, but one or both tonsils remain extremely large. Portmann reported this condition occurring in two adults. Histologic examination revealed highly hyperplastic lymphoid tissue constituted of numerous and voluminous follicles with normal connective tissue. There were no giant cells, but the pavement epithelium was destroyed here and there. In neither of Portmann's cases had tonsillectomy been performed previously. Pugnat [17] reported a case similar to those of Moure, in which the conditions seems to have been familial.

In these cases, attention to which has been called by Portmann, Moure, Pugnat, and others, the change in the tonsil is diffuse, and the

14. Renault and Cain: Bull. Soc. franç. de dermat. et syph. **23**:155, 1912.
15. Chaveaux: Arch. internat. de laryngol. otol. rhinol. **23**:880, 1917.
16. Portmann: Ann. de med. Paris **8**:187, 1920.
17. Pugnat: Rev. hebd. de laryngol. **22**:329, 1907.

differentiation between them and pure hypertrophy obviously is difficult. They are not in the same class with localized lymphoid growths of the tonsil. A case of Lavrand's [18] in a man, aged 50, whose left tonsil was enlarged by a moss of soft consistency, may be added to the foregoing. The adjacent structures were not involved. Histologic examination of fragments showed that this mass was composed of lymphoid tissue, but whether it was a matter of simple inflammation or of neoplastic tissue could not be determined clearly. The clinical evidence was clearly in favor of its neoplastic nature.

Juracz thinks that the small pedunculated lobules seen occasionally in the tonsils represent merely a hyperplasia of the tonsil itself. It is possible that the last three of our cases belong in this group.

Contrary to the opinion usually expressed, Schmidt-Meyer [19] say that "lymphadenoid" polyps are not rarely observed in the oropharynx. In their structure, these closely resemble the tonsils.

Sir St. Clair Thomson [20] presents a picture labeled "pedunculated mass of normal tonsillar tissue." No statement is made in the text concerning this specimen. He states, further, that "adenoma occurs as a smooth or irregularly rounded growth firm and sessile, and greyish or pinkish. It may be pedunculated and can then only be diagnosed by the microscope. The usual sites for it are the palate, the sides of the uvula and the tonsils." The pedunculated growth mentioned by Thomson may be similar to those described in the literature and by us.

Wright and Smith,[21] discussing adenoma in the oropharynx, say:

> In the oropharynx these are rare tumors, but they occur in rather a striking way between the layers of the velum palati laterally and not in the median line. They present a smooth surface as a rule, though there are sometimes ulcerations. These growths are apt to be a part of the mixed tumors to which we have referred as characteristic of the nasopharynx and contain epithelial and endothelial vagaries from the lymph spaces which sometimes go under the name of peritheliomata, resembling the tumors of the parotid. These growths are sometimes capsulated and can be shelled out easily. They contain glutinous colloid material. They vary in size from that of a pea to that of an orange. They may be spheroidal or ellipsoidal in contour or lobulated. In addition to the glandular epithelium and the other structures already mentioned, they may contain cartilage, bone and lymphoid material.

There seems to be a difference in opinion among the various authors as to what the term "adenoma," especially as applied to the tonsils, indicates.

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18. Lavrand: Rev. hebd. de laryngol. **25**:113, 1904.

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20. Thomson: Diseases of the Nose and Throat, ed. 2, New York, D. Appleton Co.

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Fig. 1 (case 1).—Multiple lymphoid polyps of tonsil.

Fig. 2 (case 1).—Section of one of the lymphoid polyps.

Although this paper is intended to deal with only pure lymphoid tumors, it may be mentioned that Luc [22] has reported a case of fibroadenoma of the tonsil, and Steiner,[23] Goris [24] and Horn [25] have reported cases of lymphangioma of the tonsil.

REPORT OF CASES

CASE 1.—*Multiple lymphoid tumors.*

One tonsil measured 2 cm. in length, 1.5 cm. in width and 1.5 cm. from surface to capsule. The upper pole presented a small pink mass 5 mm. in length, extending from the bottom of a crypt and protruding 2 mm. above the mouth of the crypt. The second, third and fourth crypts were free from tumors. The fifth contained

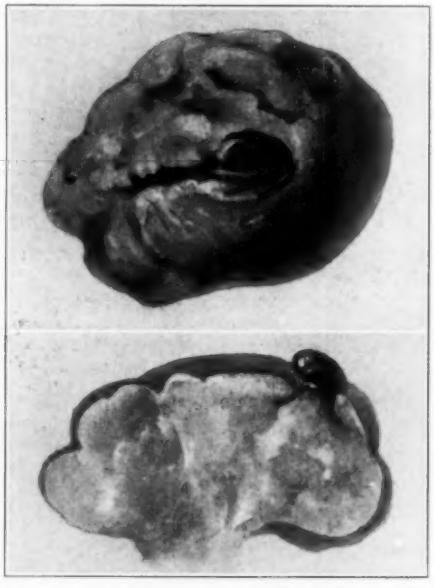

Fig. 3 (case 2).—Single lymphoid tumor of the tonsil.

the largest mass depending by a narrow pedicle from the bottom of the crypt, and measuring 12 mm. in length and 4 mm. in diameter. The mass was pale pink and curved slightly downward. At the lower pole another growth was seen, 7 mm. in length and 3 mm. in diameter, with two grooves on the surface. The upper portion arose from the bottom of a crypt and the lower border merged into the tonsillar surface. Immediately behind this tumor was another pedunculated growth 6 mm. in length, and 3 mm. in diameter, which extended from the bottom of a shallow crypt. On section the tumor masses were of the same consistency and appearance as the tonsillar tissue, which consisted largely of hyperplastic lymphoid tissue without marked increase in the interstitial connective tissue. The capsule was of normal thickness. The opposite tonsil was somewhat macerated, and revealed three small, light pink polyps arising from within the crypts. The adenoid tissue con-

22. Luc: Arch. internat. de laryngol. otol. rhinol. **9**:12, 1892.
23. Steiner: Orvosi hetil. Budapest. **7**:373, 1908.
24. Goris: J. de chir. et ann. soc. belge de chir. **10**:307, 1910.
25. Horn: Laryngoscope **21**:857, 1911.

sisted of a mass 15 mm. by 7 mm. by 5 mm.; this presented three folds and two shallow cryptlike depressions but no tumor masses. Cultures made on blood agar from the tonsillar crypts and adenoids revealed *Streptococcus hemolyticus, Streptococcus viridans, Staphylococcus albus* and diphtheroids. Microscopically, the tonsil proper consisted of hyperplastic lymphoid tissue with no marked increase in the interstitial connective tissue. The polyps (fig. 2) were composed of narrow central strands of connective tissue surrounded by hyperplastic lymphoid follicles. The epithelium was slightly thickened and of the stratified squamous type.

CASE 2.—*Single lymphoid polyp of tonsil.*

The tumor mass was small, in this instance originating from the side of the crypt wall. It measured 5 mm. in length and 5 mm. in diameter, and its pedicle was about 2 mm. across (fig. 3). The tonsillar tissue presented a slight increase in interstitial tissue and thickening of the capsule. Microscopically, the tumor revealed central strands of connective tissue surrounded by diffuse lymphoid tissue. There was no distinct follicle formation. The blood vessels were numerous and distended. The tonsillar tissue consisted of a moderate number of follicles and a predominance of diffuse lymphoid tissue with a distinct increase in the interstitial connective tissue.

Fig. 4 (case 3).—Large single polyp of tonsil.

CASE 3.—*Large single polyp.*

The tonsil measured 2.5 cm. in length, 1.2 cm. in width and 1 cm. in thickness, and presented a pedunculated, gray tumor, which emerged from the bottom of a crypt (fig. 4). The tumor measured 10 mm. in length and 6 mm. in diameter, and the pedicle was 2 mm. across. The mass was soft, and on section was seen to be composed of loose, yellowish-gray tissue. The remainder of the tonsil was typically hyperplastic with no increase in connective tissue. A small amount of gray exudate was present in a few crypts.

Microscopically, the tumor mass at the pedicle consisted of hyperplastic lymphoid tissue with a central strand of connective tissue. The remainder was composed of fibro-areolar tissue with fat deposits (fig. 5). Numerous young vessels occurred, and the surrounding stroma revealed a moderate cellular infiltration composed chiefly of lymphocytes and plasma cells. At the margin under the squamous epithelium, lymphoid tissue containing a few follicles appeared. The tonsil proper presented hyperplastic lymphoid tissue. Several crypts contained numerous pus cells, bacteria and tissue débris. A few polymorphonuclear leukocytes were observed in the epithelial and subepithelial tissue.

CASE 4.—*Single polyp of tonsil.*

A small growth of fleshlike color 8 mm. in length, and 3 mm. in diameter sprang from the bottom of a crypt. The remainder of the tonsil consisted largely of hyperplastic lymphoid tissue. Microscopically, the tumor revealed hyperplastic lymphoid tissue surrounding a connective tissue stem (fig. 6). The epithelium

Fig. 5 (case 3).—Section revealing fibro-areolar and lymphoid tissue in polyp.

Fig. 6 (case 4).—Single lymphoid polyp of tonsil.

was thin and squamous in character, and the immediately adjacent tissue showed slight cellular infiltration with plasma cells and few polymorphonuclear leukocytes.

In all of the growths described, the outstanding histologic picture was the occurrence of hyperplastic or diffuse lymphoid tissue similar to the lymphoid tissue of the tonsil itself. It is probable that they represent an unusual formation of hyperplastic lymphoid tissue rather than true new growths of the tonsil.

THE TWO-STAGE OPERATION FOR SUPPURATIVE FRONTAL SINUSITIS WITH EXTERNAL MANIFESTATIONS *

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AND
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In a previous critical study of the surgical management of cases of definite suppurative frontal sinusitis with some external manifestation, it was found that the best results were obtained by employing the two-stage, intranasal and radical operation. Further experience with the same type of disease has shown that the two-stage operation is satisfactory. The external radical stage may be avoided in certain cases in which it might have suggested itself primarily as the method of choice.

The rationale of the method seems reasonable. It was observed that the intranasal maneuver as the final stage in the external radical operation presented many difficulties; for example, the anatomic relations are inverted; bleeding interferes notably with good visibility; and in case other paranasal sinuses are involved, too radically destructive measures are required to eradicate the disease. The intranasal stage of the operation, on the other hand, performed under local anesthesia with the patient in the sitting position, overcomes these objections. The maxillary, sphenoidal and ethmoid sinuses can be attacked if necessary, and the nasofrontal duct enlarged. In other words, by this method of attack, the final stage of the radical external operation is used as the first stage in the two-stage method, except that it is performed intranasally under local anesthesia.

It is natural that patients prefer to avoid an external operation on the frontal sinus because of the possibility of scarring and unsightly deformity. However, this group of patients is anxious to be rid of the disease and is willing to accept the possibility of some deformity, if more conservative measures have failed. Some type of incomplete operation which had not controlled the disease had been performed before the patients presented themselves. The surgical treatment is formidable under the best conditions but the possibility of deformity need not be so great as to prevent external operation.

The type of disease must be determined. If it is simply a suppurative process, ample intranasal drainage will control it. If the integrity of the mucous membrane and periosteum has been assailed, and periostitis or osteomyelitis has resulted, nothing short of eradication

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of the lesion will control the disease. The choice of operation for the particular patient must be made after the consideration of the information obtained from observation of the patient and roentgenographic examination of the sinus. The exercise of surgical judgment will determine whether drainage or radical operation is necessary.

OPERATIVE TECHNIC

Prentiss has shown that one can always reach the nasofrontal duct through the lateral wall just at the attachment of the middle turbinate. We have found this to be true. It is the aim to expose this region sufficiently for the nasofrontal duct to be enlarged in a satisfactory way. In many cases it is not necessary to interfere with the ethmoid cells and middle turbinate; in fact, if it can be avoided, it is preferable to do so because the convalescence is less protracted. Removal of the denser shell of bone—the agger nasi, forming the anterior outline of this region—with a suitable forceps, flattens out the surface in a satisfactory manner, prevents pockets and is effective in promoting healing in this region (fig. 1). It is the aim to proceed forward and laterally, as Shambaugh has shown that the duct always enters the nose at an angle. Not all nasofrontal ducts can be enlarged intranasally, without undue risk. Three cases have been encountered in our work in which the bone in this area was so dense that the nasofrontal duct could not be entered. This density may have been the result of sclerosis from long-continued suppuration, or it may have been the natural density of the bony framework. In such an instance an external operation must be performed.

The nose is not packed after operation, and in the after-treatment a cannula is inserted through the nasofrontal duct and the contents of the sinus aspirated. We try to avoid irrigation with any aqueous solution. It has been found that the less the healing parts are disturbed, the better the progress made.

We have found the intranasal operation effective when we did not expect it to be. In one notable case there was a pyocele from the frontal sinus which, by pressing into the orbit and displacing the orbital contents forward, caused chemosis of the conjunctiva and ulceration of the cornea. Very much to our surprise a great change had taken place after the first twenty-four hours, and the patient felt so well after a week that he refused to have the external operation performed. He has been well since that time.

If the external operation is necessary, it can be performed after a week or ten days. The type of anesthesia is important, but is dependent on facilities and the preference of the surgeon. Recently we have used rectal anesthesia with satisfactory results, although gas and ether are well adapted for this purpose except for the obvious disadvantage.

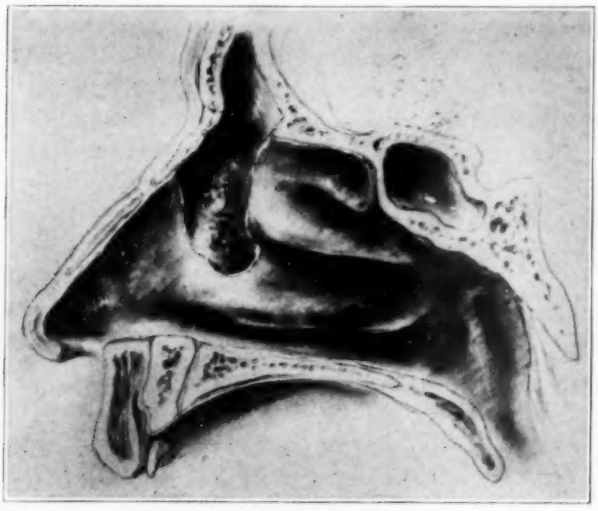

Fig. 1.—Intranasal procedure in frontal sinus operation.

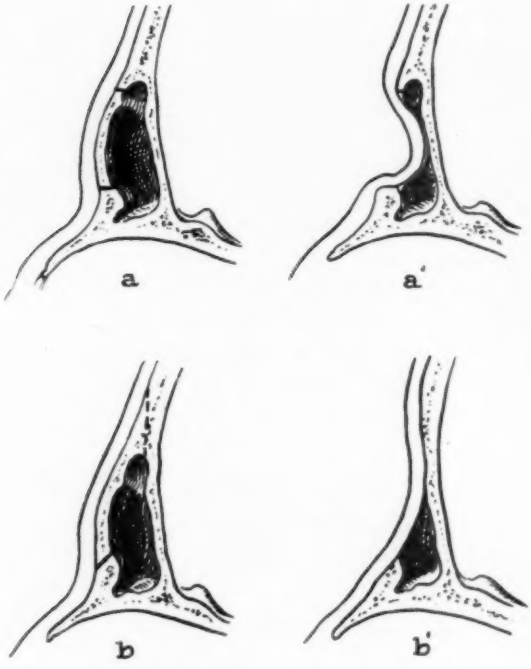

Fig. 2.—Beveling of bone edge to avoid pocketing.

In choosing the external radical operation for the individual patient, one has two objects in mind: to control the disease and to avoid unsightly deformity. When osteomyelitis of the external table has been definitely diagnosed or when the roentgenogram of the sinus shows it to be very large and divided into several cells which would be difficult to expose thoroughly from below, it would seem that the removal of the outer table is indicated. However, if the extension from the frontal sinus has been into the orbit, if evidence is not found of any disease of the outer table and if the sinus is of such conformation that it can be

Fig. 3.—Showing in profile the effect of beveling the outer table.

approached from below, an operation of the Lynch type will be found satisfactory. As a matter of fact, the Lynch type of operation is as radical as the Killian type, except that the outer table is not removed. The intranasal stage of the external operation, after the method of Lynch or Killian, is radical; in fact, except in the actual presence of suppurative pansinusitis with marked destruction, not amenable to

intranasal operation, it does not seem warranted. Here again that wise surgical rule holds good: the operation should be adapted to the patient and not the patient to the operation.

The choice of treatment for the individual patient is complicated by the possibility that the formation of infected granulation tissue will defeat the purpose of the operation, particularly when the periosteum is involved and the mucous membrane destroyed. If the formation of

Figs. 4 and 5.—Before operation.

Figs. 6 and 7.—One year after operation.

granulations could be avoided by the obliteration of the cavity, it would seem to be an advantage. It is difficult to understand how the complete removal of the mucous membrane and periosteum will result in anything but the formation of granulation tissue, unless one expects the epithelium from the nose to extend up into the cavity and cover the bone, as it does in a cavity following radical mastoid operation. If only one frontal

sinus is involved, a Lynch type of operation may be tried. If both frontal sinuses are involved and removal of the outer table seems necessary, it is easier to avoid the obviousness of the deformity than when only one side is affected, because by balancing the two sides, that is, removing the outer table in such a way that both sides are symmetrical, and beveling the upper edges of the outer table so that there is no abrupt drop of the soft parts, an unsightly deformity may be avoided. Further, the beveling of the outer edges of the external table prevents the formation of

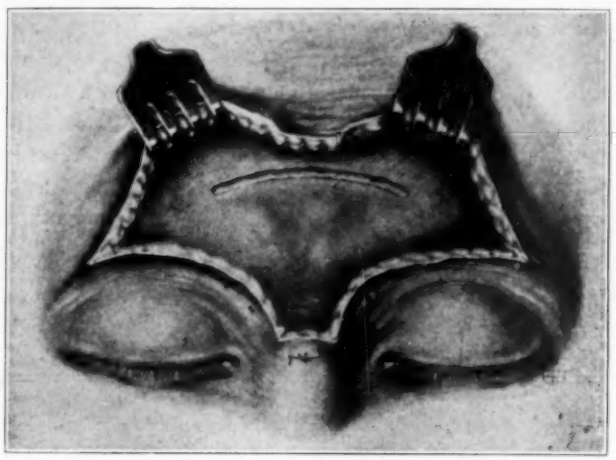

Fig. 8.—Beck's incision.

Fig. 9.—Closure of wound without external drainage.

pockets which might defeat the purpose of the operation. In the frontal sinus of considerable anterioposterior depth, cutting down the orbital ridge sufficiently to prevent an abrupt drop to the inner table will lessen the obviousness of the deformity (figs 2, 3, 4, 5, 6 and 7). In the case of bilateral disease the incision preferred is that suggested by Beck; it is better to make the incision just beneath the eyebrow than through it (fig. 8). In the case of a large unilateral frontal sinus, the

same incision affords satisfactory exposure. If the incision is carried across from one eyebrow to the other, or is carried vertically, a scar is always evident. With the Beck incision the scar is scarcely noticeable (fig. 9).

Because the intranasal work has been done, it becomes an easy matter to enlarge the nasofrontal duct from above, since the excessive bleeding encountered when the intranasal operation is performed as the end stage of the external operation has been avoided. The sinus may be drained into the nose after the suggestion of Lathrop, particularly if it is the only sinus involved. Strips of petrolatum gauze in the nose are preferred to the rubber dam or rubber tubes for the drainage. The external wound is closed by interrupted sutures without drainage. The packs can be removed at the end of two or three days, and the external wound uncovered and left exposed as ordinarily the reaction is minimal, the patient is more comfortable and the swelling subsides more rapidly.

Little or no postoperative care is necessary. The cannula may be inserted through the enlarged nasofrontal duct and the contents of the cavity removed. Healing usually takes place in from ten days to two weeks.

TABLE 1.—*Condition on Admission*

	Patients
Discharging external fistula	37
Proptosis due to pyocele or mucocele	6
Swelling, subperiosteal abscess	20
Proptosis, chemosis and corneal ulceration	1
Osteomyelitis	1
Osteomyelitis with sequestration	2

The material from which this study has been made consists of sixty cases of suppurative frontal sinusitis with some external manifestation of the disease (table 1). Of the cases presenting discharging external fistulas, there were nineteen in which the fistula came through the outer table. In seven the fistula presented in the orbit. In the other cases the fistula presented in the scar, and there is little doubt that it was the result of the external drainage that had been instituted in these cases. In one case a rubber tube was draining a brain abscess cavity directly. From what we know about the management of this type of disease, we would expect that the Lynch type of operation would take care of those fistulas that present in the orbit, if the pathologic condition encountered within the sinus itself did not entail involvement of the external table. In those cases in which fistulas presented in the forehead through the outer table, removal of the outer table would be preferred, because the osteomyelitis and infected granulation tissue which are always associated indicate the eradication of the disease. Of the cases in which definite proptosis has been produced by mucocele or pyocele or orbital abscess, the first impression is that nothing short of the radical external operation

would serve. This we found not to be so, as the worst case of proptosis, chemosis and corneal ulceration responded satisfactorily to the intranasal operation. In one case in which the mucocele caused proptosis, the nasofrontal duct could not be found, but one was improvised intranasally, and cure followed.

It will be noted that there were more previous operations than patients; there had been multiple operations in a number of cases (table 2). The further management of these cases revealed that there were certain reasons why previous operation had failed. The intranasal operation had failed because sufficient drainage had not been obtained or because intranasal drainage had been chosen in the wrong type of case. The external operation had failed because the disease had not been exposed sufficiently for complete eradication or because the site of the origin of the disease was not recognized. In a number of instances, frontal ethmoid cells were encountered at the mesial side of the duct near the cribriform which had never been opened or removed.

TABLE 2.—*Previous Operation*

	Patients
Some form of external operation	32
Intranasal operation	31
Drainage of subperiosteal abscess	14

TABLE 3.—*Pathologic Change Found at Operation*

	Patients
Suppuration	37
Suppuration plus granulation, periostitis and osteomyelitis	10
Suppuration plus sequestration	3
Pyocele and mucocele	6
Bismuth paste	1
Orbital abscess	2
Brain abscess	1

In the majority of cases the external operation had been only a trephine, which did not allow for inspection of the interior of the sinus or removal of the infected granulations, mucous membrane and periosteum. In certain cases in which an external operation had been performed no attempt had been made to establish intranasal drainage, and the wound had been dressed and packed externally.

It is evident from this group that no operation except a radical one, with careful inspection of the interior of the sinus, will eradicate the disease and establish resolution.

Careful as one may be in the preoperative diagnosis of disease of the frontal sinus, one does not really know the actual condition until the sinus has been opened (table 3). It does seem necessary that one approach the situation with the idea of adapting the procedure to the exigencies of the operation.

The external operation without previous intranasal maneuver was performed in our earlier cases, and in five instances it was necessary to perform some secondary operation. It was this experience that led us to feel that the two-stage operation might offer many advantages, because the intranasal operation as the final maneuver of the external Killian operation proved to be the most difficult to perform. Following the adoption of the two-stage operation, it has not been necessary to reoperate.

Of the sixty cases presenting some external manifestation of disease of the frontal sinus, the intranasal operation alone was effective in nineteen (table 4).

Postoperative Complications.—In the earlier cases there was considerable swelling of the lids and edema of the conjunctiva following operation, although precautions were used during the operation to avoid any unnecessary trauma. In one case in which the peri-orbita had been injured, orbital cellulitis ensued and ran its usual course; after open

TABLE 4.—*Type of Operation Performed*

External operation without previous intranasal:	
Killian operation	13
Lathrop operation	2
Lynch operation	2
Two-stage operation:	
Killian operation	20
Killian-Lathrop operation	2
Lynch operation	2
Intranasal stage only	19

drainage it subsided in a satisfactory way. In the only case in which local anesthesia was tried, orbital cellulitis resulted. We felt that this was due to infection being carried underneath the periosteum by the needle. Corneal ulceration ensued, but the final result was satisfactory; vision was not diminished, and the corneal scar disappeared in the course of six months. In eight cases there was some degree of diplopia which lasted but a few days.

It was found that the reaction around the wound and the lids subsided much more rapidly when the wound was left unbandaged. This happened first in those cases in which the orbital cellulitis made it necessary to use hot compresses. Since then it has been the routine to remove the bandage after twenty-four hours. Five patients developed postoperative tonsillitis and were very ill. One contracted meningitis soon after the tonsillitis, and we attributed it to the tonsillitis and nasopharyngitis. Necropsy did not show any break in the inner table in this case, and the course had been without incident for five days until the appearance of the acute tonsillitis. At the present time, if operation on the frontal sinus is not too urgent, we believe that the patient should be

treated for infected tonsils and all infections of the upper respiratory tract before a radical operation on the frontal sinus is begun. In one case which eventuated in meningitis, hypertrophic osteitis was encountered at operation, and it was necessary to use sharp instruments to remove the diseased tissues. Convalescence seemed satisfactory until the fourth day, when definite signs of meningitis appeared. Necropsy showed that the operation had resulted in fracture of the inner table, and that infection had extended through. Under ordinary conditions, the fracture of the inner table would be noted at the time it occurred, and removal of the fragments and wide exposure of the dura would prevent meningitis in most instances in the same way as it does in operation on the mastoid. This has occurred on two other occasions, and meningitis did not develop.

Erysipelas complicated convalescence in two cases and ran its usual course without particular incident and without deleterious effect.

CONCLUSIONS

1. The two-stage operation has continued to be a satisfactory method for the management of suppurative frontal sinusitis presenting some external manifestation of the disease.

2. Preliminary to the external operation, the patient should be treated for infected tonsils and adenoids and infection of the lower paranasal sinuses in order to lessen the danger of acute postoperative infection and meningitis.

3. Attention to certain mechanical details in technic will make the external deformity less obvious.

4. External drainage can be dispensed with if the operation has been complete.

5. The incision suggested by Beck is suitable for exposure when there is a large unilateral frontal sinus or when the disease is bilateral. Vertical incisions should be avoided.

6. Early removal of the external dressing adds to the comfort of the patient and diminishes reaction and swelling.

7. Little postoperative treatment is necessary.

INTRANASAL ETHMOIDECTOMY

COURSE AND SEQUELAE ON FRACTURING LAMINA AND INSERTING PACK

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I do not claim priority for any statements made in this article. I merely call to the attention of physicians my experiences with a procedure that many fear to use. I refer to the fracturing of the lamina papyracea while exenterating the ethmoid labyrinth and the packing of the operative field on the completion of this work.

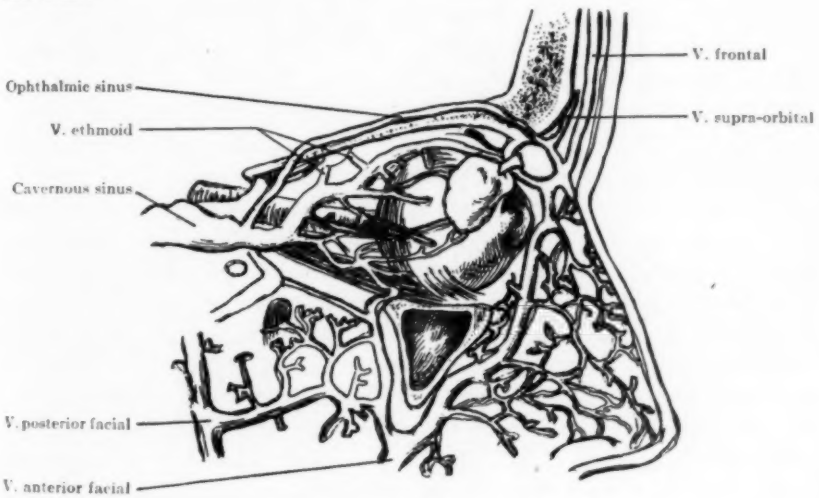
A brief review of the anatomic relations and the circulatory system of these sinuses will refresh the memory of the reader concerning this structure and will recall the reasons why an ethmoidectomy is often believed to involve danger.

The ethmoid is divided into two plates which cross one another—one horizontal and the other vertical. The vertical plate consists of a superior thick portion (the crista galli) and an inferior portion (the perpendicular plate of the ethmoid); the latter forms a part of the bony nasal septum. The horizontal plate is located where that part of the perpendicular plate is divided. This plate runs laterally, and is comprised of a medial portion, the thin perforated cribriform plate and a more lateral, thicker portion which forms the roof of the ethmoid capsule and on which rests the olfactory lobes and the mesial surface of the frontal lobes of the brain. On each side of the vertical plate are hanging capsules, which comprise the ethmoid labyrinth, and the superior and middle turbinates. Thus, speaking broadly, the ethmoid cells are bound laterally by the lamina papyracea which separates the orbital fat from these sinuses; medially, they are bordered by the middle and superior turbinates; inferiorly, by the convex downward junction of these turbinates to the lamina; posteriorly, by the blending of turbinates and lamina onto the lateral portion of the anterior surface of the sphenoids; anteriorly, by the frontal portion of the maxillary.

Unfortunately, however, these boundaries are not always constant because of the anomalous anatomic structure. Thus the variations of these cells are many, and their extension into contiguous structures may be such that even a complete exenteration of the labyrinth by way of the nasal passage is impossible. Not infrequently a cell extends anteriorly and superiorly along the anterior surface of the frontal sinus; or it extends over the roof of the orbit; or one encounters a cell extending into the wings of the sphenoid or over the roof or in front of the sphenoidal sinus. All of these abnormalities are so frequent as to bring up the question as to whether they really are abnormalities.

At times the natural bony boundaries are missing in natural dehiscences; thus the paper plate may be missing. In one case that I saw the posterior superior lateral wall was deficient, and the internal carotid artery was actually coursing in the sinus, covered only by mucous membrane.

The important structures surrounding the ethmoid sinuses may be given briefly. Above they are separated from the brain by the lateral part of the horizontal plate, while just mesial to the middle turbinate the brain is separated from the nasal cavity by only the thin cribriform plate. The orbital contents extend along the lateral surface. Posteriorly lies the brain with the optic nerve and the internal carotid artery; the latter is in such close proximity to the ethmoid sinus that if it does not take its course in the sinus, it practically always leaves an imprint on the wall.



Venous anastomosis of the nose, sinuses and orbit in relation to the cranial cavity.

CIRCULATION

The venous anastomosis of the nose, sinuses, orbit and cranial cavity is shown in the accompanying illustration taken from Quain's anatomy. The close interlacing of the venous circulation between these structures is so clearly shown that further description is unnecessary.

PATHWAYS OF INFECTION

As in other parts of the body, infection spreads by continuity or by way of the venous or lymph circulation. Where there are natural dehiscences the nasal or sinus mucosa is separated from the various surrounding structures only by periosteum; at times this is absent,

which practically means that with each inflammatory process there is a comcomitant inflammation of the contiguous tissues. An ulcerative, or inflammatory process might by continuity extend to the orbital contents, to the dura or to the brain. A thrombosis may be carried to the various venous channels of the brain by venous extension or may be carried to distant parts of the body by metastis. The infection may be carried through lymph channels, a fact which has been proved by Andre and Falcone,[1] who showed that direct channels exist between the mucosa of the sinus and the meningeal spaces. The infection may also spread along the sheaths of the optic nerve and the ophthalmic veins.

It is astonishing that complications are not more frequent and that there are not more unfavorable results following intranasal operations when one considers the various channels through which infection may spread and the complicated anatomic relationship of the sinus.

The usual procedure is not to pack the nose after ethmoidectomy and the annoyance of continuous oozing and bleeding is accepted in preference to placing any packs in the cavities. The surgeon usually says that he would feel extremely uncomfortable if he were to discover that he had fractured the laminae papyracea, and he would not consider putting a pack in the nose following an ethmoidectomy.

Infrequently surgeons are called on to operate in the course of acute purulent conditions. Loeb cautions against this, and advises postponement. However, delay is not always possible, and it is in acute cases which necessitate operation that the postoperative pack is most dangerous. I am calling your attention to the chronic sinus condition requiring surgical intervention.

Hays [2] cautions against placing a pack in the nose following an ethmoidectomy. Sir St. Clair Thomson [3] says that it is better to avoid using packs in the nose. Loeb [4] says: "The possibility of untoward results can be lessened by refraining from post-operative packing." He further cautions against leaving a pack in the nose longer than twelve hours, if packs must be used to control hemorrhage. The opinion of Katz and Blumenfeld [5] is that in ambulatory patients a pack should be inserted, but that it is not advisable to use a pack in patients in hospitals.

I do not advocate the fracturing of the paper plate, but when such an accident occurs, one need not view it with grave alarm as it is the

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1. Recheriches sur leo lymphatiguis du nez et des fossae nasalis, "Am des mal de l'nelle," quoted by Skillern: Accessory Sinus of the Nose, Philadelphia, J. B. Lippincott Co., 1925, p. 257.

2. Hays, Harold: Diseases of the Ear, Nose and Throat, Philadelphia, F. A. Davis Company, 1925, p. 723.

3. Thomson, Sir St. Clair: Diseases of Nose and Throat, New York, D. Appleton & Co., p. 216.

4. Loeb: Operative Surgery on Nose, Throat and Ear, St. Louis, The C. V. Mosby Co., p. 58.

5. Katz, Preysing and Blumenfeld: Handbuch der speziellen Chirurgie des Ohres und der oberen Luftwege, Leipzig, Curt Kalitzsch **3**:249, 1922.

present tendency to do. Were the mere exposure of the orbital fat of such grave consequence, would it not be logical to assume that there would be more orbital complications than there are, especially since dehiscences are often present and since the inflammatory process progresses into the surrounding structures? In this area, as in the region of the mouth and in the region of the rectum, nature probably has provided some adequate protective reaction that prevents constant local infections.

In regard to the infection which usually follows operative work in the nose, Katz and Blumenfeld [6] state that it is fortunate that these inflammatory conditions are of so little importance, even though the lymph and venous communications are through the lamina cribrosa.

The mere opening of the ethmoid labyrinth is a procedure which is fairly safe and quickly executed. However, it is a different problem to remove the débris from the capsule so that the walls are clean and the carious bone and the hyperplastic mucosa are entirely exenterated. The greatest danger in this operation is the breaking through the natural boundaries of the capsule. By retaining the middle turbinate, the cribriform plate will be protected; the policy of never removing anything that cannot be recognized or seen insures protection to the rest of the boundaries. The fragile lamina papyracea requires an especially delicate procedure. I believe that the reason ethmoidectomy so often is a failure is that these cells are not cleaned completely. Merely to open them is inadequate in the majority of cases, for quickly formed granulation tissue will soon prevent secretion and proper aeration, thus producing the condition that one is attempting to correct.

As a rule, if it is necessary to open an ethmoid sinus, maximum exenteration is required.

Because of this deliberate procedure, I find comfort in the knowledge that I have had a high percentage of fractured plates. I believe that the intranasal ethmoidectomies I have performed have been so successful because it is my policy always to make a complete excision.

The relative unimportance of fracturing this plate was recognized by German surgeons, and in describing the technic of the operation, the writers [7] state "that if this happens it is not of great significance."

When I have completed the operation, I deviate from the usual procedure, and I insert a pack. In the foregoing discussion it has been brought out that such a pack is considered highly dangerous, and the majority of surgeons do not use them. The pack is put in lightly, yet firmly enough to control the oozing and bleeding. Also it helps to control the tendency toward exuberant granulations and early closure of the capsule with unhealthy, infected granulation tissue. As a rule,

6. Katz, Preysing and Blumenfeld (footnote 5, p. 250).
7. Katz, Preysing and Blumenfeld (footnote 5, pp. 248 and 249).

the pack is left in place from four to five days, and if not put in too tightly is well tolerated by the patient.

SURGICAL PROCEDURE

1. When necessary a preliminary submucous resection is performed.
2. Usually it is necessary only to fracture the middle turbinate; thus the normal physiology of the nasal mucosa is interfered with to the minimum degree, and the safety of the cribriform plate is insured.
3. The agger nasi cells are broken into with a Hajek hook.
4. The agger cells are removed with a Hajek biting forceps. If necessary, a West chisel may be used to remove the anterior nasal process, thus opening the first group of anterior ethmoid cells, and allowing better drainage for the frontal sinus.
5. The uncinate process is broken into with the Hajek hook.
6. The uncinate process is removed with the biting forceps.
7. The bullae ethmoidalis are broken into with the hook.
8. This allows the use of the biting forceps and the removal piecemeal of the second group of anterior cells.
9. Following the removal of the anterior cells, one breaks into the posterior group by the use of a blunt instrument pressing posteriorly and slightly downward, applying the instrument in the center of the posterior plate.
10. The part of this group of cells that can be seen is removed with the biting forceps.
11. All spicules should be bitten away and all hyperplastic tissue removed until the cavity apparently is clean and smooth.
12. Packing is then inserted; in packing the field, the first strip should be carried posteriorly and along the roof of the field. Successive strips should be carried in until the cavity is lightly but completely filled.
13. The use of the curet is not advisable, and nothing should be done unless one can see clearly what is being done and what is being bitten off.
14. Postoperative Treatment: The patient should be put to bed and an ice cap applied to the head. Headache should be treated symptomatically; and the temperature should be watched closely. At the end of the fourth or fifth day, depending on the tolerance of the patient for the pack, the pack should be removed. On successive days for the following two to three weeks the cavity should be cleansed with a mild alkaline solution, and silver nitrate from 2 to 5 per cent applied thoroughly over the operative field.

The following data give one an idea of the usual postoperative course after an ethmoidectomy when the lamina has been fractured and a pack has been inserted. No attempt is made to give more than the positive results, and data from only three of the twelve cases are reported; the rest of the cases in the series are very much like these.

PROTOCOL

CASE 1.—Mr. R., aged 51; chief complaint: boring temporal headaches.

Diagnosis: Hyperplastic ethmoid sinuses of both sides.

Operation: Complete exenteration of ethmoid cells of both sides. Lamina fractured on the right side during course of operation. Area packed.

First Day: No emphysema; severe pain over right eye; no rise in temperature; eye bandaged; pain controlled with coal tar derivatives.

Second Day: No rise in temperature; slight headache.

Third Day: Dull headache; no fever.

Fourth Day: Headache more severe; pain over right eye; no fever.

Fifth Day: Severe headache; no fever. Packing removed.

Sixth Day: Dull headache; no fever. Sitting up in chair. Cavity irrigated; silver nitrate applied locally.

Seventh-Twelfth Day: Daily irrigation and cauterization. Headaches gradually diminished.

Fourth Week: Recovery uneventful; congestion of mucosa, none; granulation tissue, apparently healthy; no eye symptoms.

CASE 2.—Mrs. R., aged 39; chief complaint: headaches, dull pain over right eye.

Diagnosis: Polypoid, hyperplastic ethmoid sinuses.

Operation: Ethmoidectomy, right side; lamina fractured, area packed. Before patient could be warned about refraining from blowing her nose, she did so, and there resulted a profuse emphysema of her lids, and orbital tissue; eye tightly bandaged.

First Day: Heavy dull feeling in eye; slight headache; temperature normal; emphysema still prominent.

Second Day: Dull pain over frontal sinuses; pain in eye slight; emphysema diminished; no increased temperature.

Third Day: Temperature subnormal; heavy feeling in eye; slight headache.

Fourth Day: Headache as on previous days; emphysema practically absent; temperature 99.8 F. by mouth.

Fifth Day: Severe headache; temperature 100.4 F.; packing removed.

Sixth Day: Feeling comfortable; still complains of pain over eye.

Sixth-Twelfth Day: Irrigated daily and silver nitrate applied; mild headache; eye symptoms had practically disappeared.

One Month: At the end of the first month, the patient said that headaches were a thing of the past; no eye symptoms; slight nasal discharge. Each morning she blew large crusts from the nose.

CASE 3.—Mrs. M., aged 34; chief complaint; asthma, nasal discharge and difficulty in breathing through nose.

Diagnosis: Polypoid ethmoid cells and antrum, on right side; ethmoid cells on left.

Operation: Antrum first operated on; Caldwell-Luc operation revealed a thick mass of polypoid tissue, completely filling cavity. At end of second month, a double ethmoidectomy was performed; masses of polypoid tissue removed from both sides; lamina on left side, fractured; cavities packed.

First Six Days: The patient was not uncomfortable at any itme. Apparently she did not suffer any discomfort from the operation and the packs, because she had accustomed herself to breathe through the mouth and because her nose had been full of polyps. At the end of the sixth day, packs were removed, and the nose was treated as in the previous cases. Her recovery was phenomenal; her sense of smell returned; there was no nasal discharge, and even her asthmatic attacks became fewer. One year after the operation, she had only mild asthmatic attacks. In this case, as in the previous cases, the fracture of the lamina was not important, and the insertion of the packs caused no material symptoms.

SUMMARY

1. Ethmoidectomy should be performed only by those familiar with nasal anatomy and skilled in operating on the nose.

2. Intranasal intervention requires, as a rule, maximum exenteration.

3. Removal of all spicules and leaving the walls smooth result in more rapid recovery and more satisfactory results.

4. Fracture of the paper plate is not a serious complication.

5. Packing insures more healthy granulations. Packing is not a dangerous procedure and is the method of choice. It is better than to allow rapid regranulation of the infected area.

PROGRESS IN OTOLARYNGOLOGY

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

ANATOMY AND PHYSIOLOGY OF THE EAR

REVIEW OF THE LITERATURE FROM OCTOBER, 1925, TO OCTOBER, 1926

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The recent studies on the anatomy and physiology of the ear have aroused the interest of otologists throughout the world. These studies are of prime importance not only to aurists but also to neurologists and ophthalmologists. There has not been any work published since the time of Bárány that has had more effect in producing this stimulus than the accounts from the Utrecht school of physiologists, notably that of Professors Magnus and deKleijn.

Clinical observations have added much that is of interest in the way of explanation of these physiologic points. The methods of clinical stimulation of the labyrinth are becoming more and more refined, that is to say, an attempt is made to avoid rudely shocking the sensorium of the labyrinth by using minimal stimuli, and from all accounts further refinements of the methods of examination will be adopted. It is not proposed to discard the present methods because interpretation of the test cannot be accepted as conclusive, but whenever fine differentiation is desired, the best evidence is obtained by the more delicate methods.

Articles in this summary will seemingly be long and incomplete, owing to the difficulty of explaining physiologic and experimental observations, but a longer review would still leave much to be desired, as one cannot include the details of experiments and the description of photomicrographs with justice to the author

HISTOLOGY

Gross anatomy has not attracted many investigators during the past year. More detailed examinations seems to have been made of the structures which form the organ of hearing.

Iwasa [1] describes the cytologic study on the tissues of the membranous labyrinth of the guinea-pig. He has shown that every cell of the internal ear has its own individual fine interior structure. The plastosomes serve principally in the formation of the cell structure, the dark granules, lipoids, pigment and vacuoles. All of these elements differ entirely in form, size, amount and distribution, so that the structure of each cell must differ from that of any other. Hitherto, not much

1. Iwasa, Morizo: Folia anatomica japonica **3**:313 (Dec.) 1925.

has been said in the literature concerning plastosomes which may possibly correspond to the granular stratum of the hair cells and the filamentous structure of the Hensen cells (both described by Retzius in rabbits). He states that although the morphologic structure of the labyrinth can be apprehended, the biologic significance of the cells is a more difficult matter. Probably, different functions are comprised, and later it may be possible to assign some special functional significance to different morphologic elements. He describes thoroughly the stria vascularis, the inner and outer hair cells, the Hensen cells, the epithelium of the limbus spiralis and other structures in reference to the presence of plastosomes, lipoids, vacuoles and other constituents. Authors differ regarding the functional significance of plastosomes, but the majority agree in assigning to them an important part in the cell functions.

Solovcov,[2] in studying the ends of the acoustic nerve in Corti's organ, made these examinations on fresh cadavers of children. Care in the preparation of the specimen before putting in the fixing solution is emphasized. All excess bone must be removed, and the membranous labyrinth exposed for as great an extent as possible; the specimen is then put in 10 per cent liquor formaldehyde solution. After the fixation is complete, the rest of the bone is removed as well as the lamina spiralis, the ligamentum spirale and Reissner's membrane, so that only the basillar membrane, the limbus spiralis and Corti's organ remain. This part is stained by Bielschowsky's method. On the basis of three photographs of histologic specimens, Solovcov gives a diagrammatic drawing of the different types of ending of the eighth nerve, and describes eleven possible forms. The details of these can be understood only by seeing the illustrations. This author thinks that the question of whether the nerve fibers only pass around the auditory cells or whether they penetrate their protoplasm, cannot be determined by this method of staining. He succeeded, however, in finding some cells in which the nerve fibers entered directly into the protoplasm.

Portmann and Kistler,[3] studying the anatomy of the internal ear, were impressed by a special arrangement of the epithelium of the semicircular canals which does not seem to have been described previously. In their first article, which is short, they describe an oblique section of the semicircular canal in man and in mammals showing an internal taenia or band presenting the appearance of a mosaic of narrow cells, and an external band with somewhat larger cells but easily distinguished from the epithelial cells of the rest of the canal. The internal taenia or band is followed for its entire course along the rest of the semicircular canal by a blood vessel of the large venous capillary type. A smaller

2. Solovcov, N.: Čas. lék. česk. **64**:241 (Feb. 14) 1925.
3. Portmann and Kistler: Comp. rend. Soc. de biol. **93**:1513 (Dec. 18) 1925; Rev. de laryngol. **47**:1 (Jan. 15) 1926.

vessel follows the external band less closely on its course along the external border of the semicircular canal. The cells of the internal band are two or three times smaller than the cells of the surface of the canal; they are serrated, and the nucleus occupies a large part of the area of the cell. The cells of the external band are somewhat narrower and less serrated, but are of the same general type.

These authors describe the same structures in greater detail in a later essay.

Giesswein [4] describes the mechanical conditions of the basilar membrane, particularly in the basal turn and in their relations to acoustic injuries. He maintains that the attachment, thickness and strength of the basilar membrane and individual cells of Corti's organ at the basal turn of the cochlea, compared to the upper turns indicate that there is a greater functional demand made at this point.

Because of this fact there is a greater physiologic predisposition to acoustic injuries.

He concludes that from histologic and physiologic observation, this area is primarily affected by disease or by mechanical factors, and that it is a point of least resistance for neuritis of the auditory nerve due to many causes, as for instance, infectious diseases, faulty metabolism and other diseases. Senile deafness also doubtless affects a basilar membrane weakened in this way.

EMBRYOLOGY AND COMPARATIVE ANATOMY

Kolmer,[5] in his article dealing with the new knowledge of the human labyrinth, treats especially of Hensen's duct with the nerve rudiments, transversely striped muscle, innervation, glycogen and the disappearance of the great tuberosity in embryogenesis. In regard to Hensen's duct, as found in various animals, the author found in well preserved human fetuses a homologous equivalent of the papilla of that structure, which suggests that the latter may persist into the postembryonal period. New data were obtained referring chiefly to horizontal processes which run in various directions and form a bridge between the neurofibrillary calyces which surround the hair cells and other widely remote cells. Corresponding details were also seen in the organ of Corti. These may be aberrant embryonic structures.

Heretofore the knowledge concerning the disappearance of the great tuberosity has been defective. Kolmer was able to demonstrate a particularly interesting stage of this process in a delicate cell layer at the height of the tuberosity which represents a continuation of the

4. Giesswein, Max: Beitr. z. Anat., Physiol., Path. u. Therap. d. Ohres **22**:287, 1925.

5. Kolmer, W.: Arch. f. Ohren-, Nasen- u. Kehlkopfh. **114**:225 (Dec.) 1925.

reticular membrane in the organ of Corti, although the cell bodies and nuclei are drawn out into extremely delicate filaments. He states that glycogen plays a part in the embryogenesis of the different parts of the labyrinth. He found an abundance of stored glycogen in the deeper cell layer of the stria in the fourth fetal month; at this time, there was also an abundance of glycogen in the epithelium of the external auditory canal, especially in the membrana tympani and in the cartilage and connective tissue.

Tokura's [6] experimental researches into the mechanism of development of the auditory vesicle and the acoustic and facial ganglion in *Anurae* leads him to conclude that the substratum material of the auditory vesicle, which represents only a thickening of the sensory plate, does not show any microscopic differentiation and contains the future labyrinth with the power of self determination. This he determined by experiments in which he transplanted this structure from one side to the other, and also by rotation along with its entire epidermal layer. Practically normal development occurred. In regard to the influence of the brain on the development of the vesicle, his experiments show that the epithelial aggregation which is to be the future labyrinth can originate independently of the brain on the same side. In other words, the cerebrum cannot play a rôle in the first origin of the vesicle. The author continues to describe the origin of the facial and acoustic ganglion, and concludes that the acoustic ganglion does not originate from the common substratum with the facial but from the wall of the auditory vesicle.

Shambaugh [7] found that by removing the skull cap and brain of young embryo pigs and allowing the tissues to become fixed in Mueller's solution for several weeks, he could easily tease away the tissue surrounding the labyrinth and obtain preparations without distortion and the production of artefacts He was able to secure a series of preparations showing the development of the internal ear from an embryo 3.5 cm. in length to the full term fetus.

Nishio,[8] studying the origin of the otoliths, gives a detailed description, illustrated by photomicrographs, of the otoliths of birds, fish and the lower forms of mammals. He studied human embryos 20 mm. and 28 mm. in length, but he did not find any trace of otoliths and assumes that they are not formed until later. The otoliths that first appear in a human embryo 70 mm. in length from breech to vertex are so small that they can hardly be seen. They can be stained only with silver; small amounts of free acid causes them to disappear. The stained

6. Tokura, Raisuke: Folia anatomica japonica **3**:173 (Oct.) 1925.
7. Shambaugh, George: Arch. Otolaryng. **3**:233 (March) 1926.
8. Nishio, S.: Arch. f. Ohren-, Nasen-u. Kehlkopfh. **115**:19, 1926.

calcium bodies are best observed in polarized light; so it is not surprising that Alexander did not find them until the embryo was 125 mm. long.

In human fetuses, not only are the otoliths stained coal black, but some intense black areas appear on the surface of the sensory epithelium in fetuses 95 mm. in length. These black areas are found only in the region of the maculae, not of the cristae, and the cupulae are also free from them. Nishio emphasizes the fact that there is not any black stain either in the superficial or in the deeper structures of the cristae, while there is a definite staining of the macula utriculae and a lesser stain in the macula sacculae. The conclusions from his comparative study brings him in contradiction to the various theories held by Stricht, Wittmaack and Herzog. Stricht assumes that the sensory epithelium cells form the otoliths, but Nishio found fewer otoliths than sensory cells in many animals, so that the number of otoliths does not seem to correspond with the number of epithelial cells. Contrary to Wittmaack, who thinks that the cell hairs are involved in the formation of gelatin and form drops of gelatin otoliths, the author saw crystals in considerable numbers in various animals at a time when the best cytologic methods did not show a trace of hair, which developed later. In part, he agreed with Herzog, but he did not see any migrating or dying cells which seemed to be connected with the process of excretion of gelatin which precedes otolith formation.

Benjamins[9] studied Vitali's paratympanic organ in birds. This organ was described in 1911 by Vitali, and in 1922, vanWijhe, the anatomist, described these organs in birds and in species of the lower vertebrates. In the higher vertebrates, this organ reaches only a certain stage of development and disappears in the later stages of the embryonic life. Benjamins' experiments on pigeons did not confirm Vitali's observations. He destroyed the organ by cautery, and microscopic examination showed that the destruction was complete. The theory that this organ is concerned with flight and the sense of orientation which is so remarkable in carrier pigeons, is refuted entirely by Benjamins, who thinks therefore that this organ is not concerned either with the movement or with the direction of flight; he says that he does not know what its real function is.

Romano[10] describes the macroscopic and microscopic structure of the tensor tympani in different mammals and discusses its physiologic functions. In animals with sharp hearing, such as cats, dogs, horses and goats, the tensor tympani is considerably more developed than it is in animals with less sensitive hearing, such as cattle. In cats, dogs and other mammals, there are two directions of the fibers, corresponding

9. Benjamins, C. E.: Rev. de laryngol. **47**:58 (Jan. 31) 1926.
10. Romano, Serafino: Valsalva **2**:49 (Feb.) 1926.

to the perpendicular direction of the tendons of origin and insertion to each other. It is possible that the two parts of the muscle contract independently although synchronously. Several illustrations are given, some of them photomicrographs.

PHYSIOLOGY—VESTIBULAR

At the combined meetings held in Montreal in May, 1926, articles by Professor Tait [11] and Professor Magnus were read before the otologic society. Professor Tait clearly and precisely relates his work on the labyrinth of the frog. He will not assert that there is similarity of action in the human being until he has completed further work.

Professor Magnus [12] summarizes the results of his inquiry into the physiology of the labyrinth, and as this work was reviewed in 1926, further comment is not made at this time. It is unquestionably the outstanding scientific investigation of the function of the labyrinth in recent years.

Rademaaker's [13] article is an anatomic supplement to the ideas of Magnus and deKleijn. Many animal experiments and microscopic examinations were performed with that accuracy which is characteristic of the Utrecht school. Rademaaker's observations give a clear explanation of the function of the red nucleus. He found that the difference between a dethalamized animal with normal muscle tonus and normal position and a decerebrated animal with decerebration rigidity was caused by the function of the red nucleus. Exclusion of the red nucleus led to loss of labyrinthine position reflexes and of reflexes of the body. The red nuclei are the centers for the normal distribution of muscle tonus, for reflexes of the labyrinth and for the reflexes which maintain the position of the body. Further details of the function of the red nucleus are given, but the point of chief interest in otology is that it controls the reflexes of the labyrinth.

Lorente de Nò [14] frankly declares himself against the theories of recent workers on labyrinthine reflexes, particularly those pertaining to the eyes. He was able to measure the changes in the length of the muscles of the eye during and after the rotation of the head in three axes in order to test the influence of the canals and otoliths on the muscles, and he concludes that the observations of Breuer, Magnus and deKleijn and Quix, are not tenable in the face of his experiments. Against the theory

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11. Tait, John: Ablation Experiments on the Labyrinth of Frogs, Arch. Otolaryng. **4**:281 (Oct.) 1926.

12. Magnus and deKleijn: Experimentelle Physiologie des Vestibular Apparatis bei Sangetieren mit Ausschluss des Menschen, Handb. d. Neurol. d. Ohres **1**:465-532, 1923.

13. Rademaaker, G. G. J.: Monog., Berlin, Julius Springer, 1926, p. 340.

14. Lorente de Nò, R.: Acta Oto-laryng. **9**:163, 1926.

that the origin for muscle tonus in the eye exists in the otolith apparatus, he quotes the work of Beck, in which tonic reflexes can be greatly reduced by stopping the semicircular canals; also the work of Maxwell who has shown that tonic reflexes in fish are called forth after extirpation of the otoliths. The author feels that factors other than the action of the labyrinth must cooperate in the tonic reflexes of the eyes, irritation from other nerves being the other factor. To prove the latter, he extirpates one eye (left) in a rabbit and produces phenomena similar to those arising after extirpation of the labyrinth; namely the rabbit held with head hanging downward turns the head to the left, and in the right eye there is a backward nystagmus. These reflexes partly proceed from the opticus and partly from the sensible proprioceptive apparatus of the muscles and other tissues of the orbit.

Spitzer [15] reports his study on the function of the semicircular canals. He gives a critical discussion of the different theories regarding stimulation of the semicircular canals. He holds the Mach-Breuer theory improbable, as a current could hardly flow normally in the semicircular canals on account of their narrowness. The anatomic structure suggests, on the contrary, that the whole semicircular canal system is protected from currents. The endolymph current therefore is not a normal activity of the system, but an accompanying phenomenon which disturbs specific function when excessive demands are made on it. The author explains the specific sensory stimulus of the semicircular canals as follows: Rotation of the head produces longitudinal waves in the endolymph, and the wave crest in the ampullar end furnishes the specific physical sensory stimulus, while the wave impact on the cristae represents the specific physiologic sensory stimulus. The membranous labyrinth enlarges the amplitude of the waves indirectly by the transverse oscillation which it brings about, and in this way it increases the energy of the longitudinal waves so that the specific sensory stimulus is sensitized. The perilymph acts as an air damper, and in this way makes it possible for the apparatus to adapt itself to a rapid alternation of succeeding stimuli.

On rotary movement, during the whole duration of the movement there is a centrifugal pressure on the sensory epithelium of the crista while this pressure is lacking on movement straight ahead. On locomotor movement (walking), there are also periodically repeated impulses to movement as a result of the oscillating progressive movements with constant change of direction and rapidity. Like every sensory organ, the semicircular canals also have their motor reflex path. Spitzer goes on to explain rotary nystagmus as well as pathologic and

15. Spitzer, A.: Monatschr. f. Ohrenh. **59**:1131, 1925; ibid. **60**:180 (Feb.) 1926.

caloric nystagmus. The article is highly technical and contains a wealth of detail with mathematical formulae and diagrams which cannot be reproduced in an abstract.

An interesting reply and discussion of Spitzer's theory is given by Retjo,[16] to which, in turn, a reply is made by Spitzer. These articles, especially those of Spitzer, are illuminating.

Simonelli and Di Giorgio [17] discuss the theories of Bárány and of Magnus and deKleijn in the relationship of the cerebrum to the labyrinth. The views held by these authors are contrary to each other. Bárány tries to explain the absence of past pointing in the pointing experiment in cerebellar lesions on the theory that there are reflex centers in the cerebellar cortex which are interposed in the path of the vestibular reflexes. Magnus, on the other hand, observed that all the labyrinthine reflexes can be produced in animals even after complete removal of the cerebellum.

The authors, in order to explain this contradiction, produced unilateral lesions of different degrees in the cerebellums of cats and dogs; these lesions extended to complete removal of one half of the cerebellum. The explanation of the apparent contradiction in the observations of Bárány and those of Magnus and deKleijn lies in the fact that past pointing is to be counted as a tonic labyrinthine reflex. Magnus examined animals in which there were no cerebellar disturbances of tonus because the cerebellum had been completely excluded, while Bárány found unilateral loss of function of the cerebellum in patients. As a result, they had asymmetry of tonus which could not be overcome by the vestibular reflexes (deviation of the pointing arm on stimulation of the semicircular canals). So although Bárány's theory of vestibular reflex centers in the cerebellum seems to be contradicted by the observations of Magnus and deKleijn, it does not follow that the cerebellum does not have any effect on the vestibular reflexes. Simonelli and observations show rather that these reflexes are greatly influenced by the cerebellum.

Spiegel and Demetriades [18] performed experiments on rabbits and cats for the purpose of determining the parts played by the different parts of the brain in central compensation for loss of the labyrinth. They found that Bechterew's compensation for unilateral loss of the labyrinth occurs in animals, not only after the deprivation of the cerebrum, but also after the loss of the cerebellum; and that the loss of the

16. Retjo, Alexander: Monatschr. f. Ohrenh. **60**:179 (Feb.) 1926; ibid **60**:426.

17. Simonelli, E., and Di Giorgio, Anita: Riv. otoneuro-oftalmol. **2**:362, 1925.

18. Spiegel, E. A., and Demetriades, T. D.: Arch. f. d. ges. Physiol. **210**:215, 1925.

cerebellum does not present retrogression of the spontaneous nystagmus that appears after unilateral extirpation of the labyrinth.

Demetriades [19] experimented on guinea-pigs, making pathologic examinations of vasomotor disturbances of the ear. He found that paralysis of the sympathetic innervation of the vessels of the ear leads to difference in tonus between the extremities of the two sides.

There is increase in skull resonance on the homolateral side and slight functional disturbance of the cochlea and vestibular nerves on both sides, particularly on the homolateral side in animals that live longer than two months. The vasomotor disturbances are accompanied by anatomic changes. The pathologic-anatomic change on which these disturbances are based is in part an angioparalytic labyrinthopathia. This is histologically the mildest degree of disease of the labyrinth and seems to be the starting point of the first stage of the other inflammations and degenerative processes of the labyrinth.

EXPERIMENTAL PHYSIOLOGY-COCHLEA

Jellinek [20] describes his experiments on the hearing of birds. The anatomic differences in the structure of the middle ear in birds and mammals were suggestive of physiologic differences in the function. In order to test this problem, the author's object was to test the abolition or decrease in function after the extirpation of the middle ear in pigeons. He employed two methods. 1. He tested the auditory capacity by wakening from the so-called hypnotic state. 2. In the training method, he taught the birds to distinguish the difference in tones between a2 and a3. The results of the experiments justify the following conclusions: (*a*) Birds can be hypnotized by being placed on their backs, and in this condition their capacity of hearing can be tested between reflex reactions to sounds. (*b*) Pigeons in which both tympanic membranes and both collumellae have been removed do not manifest a decrease in their auditory reaction if tested by the method described. (*c*) Animals operated on and trained to the discrimination of sound intervals will learn to distinguish an octave and, under continuation of the training, to distinguish a quint. (*d*) The observations show that with the employment of the two methods a difference in auditory sensitiveness between normal pigeons and those deprived of the middle ear can not be distinguished.

Tullio,[21] in previous researches, shows how sounds produce in the intact animal all the movements of the eyes, head, trunk and limbs which are provoked by other experimenters by means of mechanical exci-

19. Demetriades, Th. D.: Monatschr. f. Ohrenh. **59**:1074, 1925.
20. Jellinek, A.: Arch. f. d. ges. Physiol. **211**:64 (Jan.) 1926.
21. Tullio, P.: Arch. ital. di otal. **36**:667 (Nov.-Dec.) 1925.

tation of the semicircular canals, and that with injury to both homonymous canals the movements provoked by sounds have always the plane of the injured canals. He called these movements sonorous reflexes. In the numerous experiments made by the author with these sonorous reflexes, he noted that when an intense sound was conducted directly through the trumpet to the ear, he did not obtain the characteristic movement in the plane of one of the canals but a rotation of the head about the anteroposterior (occipito-frontal) axis, in general, carrying the vertex toward the side opposite the stimulated ear. Likewise he noted in animals with lesions of the individual canals that when the stimulus was too strong, or when the lesion affected the entire labyrinth, this characteristic movement did not appear, developing perfectly in the plane of the canal and reappearing with a difference in intensity, duration and rapidity. These movements of rotation of the head accompanied by analogous movements of the eyes were attributed by the author to stimulation of the utricle and the saccule; they are accompanied by unequal tension of the dorsal muscles, causing deviation and torsion of the vertebral column and frequent movement of the limbs. Tullio's article contains ninety-seven plates with several hundred single figures. A detailed account of the experiments is given.

Spiegel and Kakeshita [22] performed experiments on guinea-pigs and cats to determine whether motor reactions could be produced by sound stimuli after sectioning the brain stem in front of the midbrain and removing the roof of both pairs of corpora quadrigemina or after cutting the central nervous system. But of the mesencephalon it was found that shrill whistling was the best sound for eliciting motor response in the cochlea in animals with the hemispheres removed The experiments showed definitely that it was not necessary for the corpora quadrigemina to be preserved in order to elicit motor response to sound stimuli, or, in other words, that these acoustic reflexes could be produced by parts of the central auditory tract lying in the rhombencephalon. This is merely a brief summary of the subject matter contained in the author's extremely technical article, "With What Part of the Central Nervous System Are Cochlea Reflexes Connected?"

THE FISTULA SYMPTOM

Ramadier and Huet [23] report the case of a patient with labyrinthine fistula who showed Mygind's vasomotor fistula symptoms to a marked degree. Nystagmus was caused by any sudden change in the blood

22. Spiegel, E. A., and Kakeshita, T.: Monatschr. f. Ohrenh. **60**:554 (June) 1926.

23. Ramadier and Huet: Arch. internat. de laryngol., otol., rhinol. et broncho-oesophagoscopy **5**:359, 1926.

supply of the head, due to placing the head in a horizontal position, raising it suddenly, compressing the blood vessels of the neck, blood compression of the abdomen, inhaling amyl nitrite and other stimuli. If the blood supply was increased, the nystagmus was toward the normal side; if it was decreased, the nystagmus was toward the decreasing side. This symptom is explained by Mygind as being caused by the pressure of the vascular granulation tissue on the membranous labyrinth, which increases with increased blood supply and decreases with its decrease.

Ramadier,[24] in an article titled "The Pneumatic Test," discusses and compares the labyrinth fistula symptom (Lucae), the air pressure test in hereditary syphilitic labyrinthitis (Hennebert) and the sign which occurs in ordinary uncomplicated inflammation of the middle ear (Karlefors-Nylen). When comparing these three tests, he makes comments only concerning the pneumatic test.

Like all vestibular reactions, the pneumatic test, when it is complete, shows three kinds of phenomena: movements of the eyeballs, movements of the trunk and extremities and subjective sensations of dizziness which may or may not be accompanied by nausea and dizziness. The first of these three kinds of phenomena is the most constant. The dizziness, and especially the movements of the trunk and extremities are frequently lacking. Therefore, the movement of the eyeballs is sufficient to constitute a positive sign. This oculomotor reaction consists in "nystagmus" or in a "slow movement" of the eyeballs in the reverse direction from that of the nystagmus, of which it represents the slow or fundamental phase. The direction of the oculomotor movements varies, depending on the disease which causes them; they may be toward the ear on which the test is performed or in the opposite direction. They may be horizontal, rotatory mixed, oblique or vertical. The reaction may appear in only one stage of the test (compression or aspiration) or in both; in either case, the direction of the movement caused by compression is the opposite of that produced by aspiration. The reaction is sometimes immediate, and sometimes it follows the compression or aspiration after several seconds.

In general, the movements of the trunk and extremities are in the reverse direction from the nystagmus and the dizzy sensations; the subject bends or sometimes only turns his head in the direction opposite to the nystagmus and to the side opposite that toward which he feels himself drawn. The dizziness, which is purely subjective, is essentially a feeling that surrounding objects are being displaced, and that the subject himself is being drawn in the direction of the nystagmus. The observations are the same whether the subject has his eyes open or

24. Ramadier, J.: Ann. d. mal. de loreille, du larynx. **45**:149 (Feb.) 1926.

closed, or whether he is sitting or lying down. All of the phenomena last only while the test is being applied. They generally do not last beyond it, but occasionally the dizzy sensation may persist for some hours.

The results of the test are usually negative in the normal ear, although a few cases have been reported in which they were positive without any ear lesion. These positive results, however, were at most a slight sensation of displacement of objects, which could not be regarded as pathologic. The conditions which cause a pneumatic reaction are: fistula of the labyrinth, late hereditary syphilitic labyrinthitis and certain ordinary cases of otitis. A detailed study is made of the pneumatic sign in each of these conditions.

Charousek [25] frequently observed that in fistulas of the labyrinth the disturbances or the symptoms on short rotations of the head simulated an increase of excitability, while, on the other hand, caloric and rotary tests showed a decrease. He explains this difference of excitability as being due to the fact that the mechanical defect in the wall of the semicircular canal caused by the fistula, on short movements or rotations, brings about an increased rapidity of the lymph current as the rigid wall is interrupted by the fistula, while in caloric stimulation and the slower movement during the rotary test, this process does not play an essential part.

THEORIES OF CALORIC NYSTAGMUS

Borries [26] reviews the discussion of the question of caloric nystagmus since 1920. He then considers the manner in which caloric nystagmus is produced. The site of production (the semicircular canals) is determined only for rotatory nystagmus. For the other experimental forms of nystagmus, fistula test, vascular fistula test and galvanic test, little is known concerning either the site or the cause of their production, so that at present they can be regarded only as general reactions of the labyrinth. If only one is considered, for instance the right labyrinth, its chief effect, represented in a simple form, is a capacity for nystagmus directed to the right or to the left. As the former is the stronger, a nonspecific increase or decrease of function will produce a nystagmus to the right or to the left. A nystagmus to the right may also be brought about by isolated increase of the capacity for nystagmus to the right or inhibition of that to the left. The latter two possibilities are a specific action, the former a nonspecific one. The former agrees with Bartels' theory.

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25. Charousek: Ztschr. f. Hals-, Nasen- u. Ohrenh. **14**:56, 1926.
26. Borries, G. V. T.: Ztschr. f. Laryngol., Rhinol. **14**:253 (April) 1926.

Borries regards caloric nystagmus as a specific action. The labyrinth is to be regarded as a sensory organ whose chief physiologic effect, represented in a simplified form, is a capacity for homolateral and contralateral nystagmus. For reasons that are not known, this sensory organ has the characteristic that these two capacities for nystagmus of the one labyrinth may be brought about by a series of inadequate stimuli and in a constant way, so that a definite direction of the nystagmus corresponds to a certain "prodrome" of the stimuli. Concerning caloric nystagmus, Borries believes that it is only a new example of the fact that the labyrinth is as constantly sensitive to inadequate stimuli (pressor, galvanic, etc.) as it is to adequate stimuli. The caloric stimulus is only a new member in the series of such stimuli, and the effect of the caloric stimulus is just as difficult to understand as that of the other stimuli. He thinks it probable that other factors, such as changes in labyrinth pressure and vessel reflexes, play a part in the reaction.

Lannois and Gaillard,[27] with a view to testing the part played by the sympathetic system in Bárány's caloric test, experimented on rabbits after having sectioned the cervical sympathetic nerve and removed the superior cervical ganglion. These experiments showed that in rabbits, in most of the cases, in addition to the classical changes in the vascularization in the external ear, there is also a change in the caloric nystagmus. This operation generally causes delay in the appearance of the nystagmus (increase of the latent period) and a marked decrease in its duration. These phenomena appeared to a slight but perceptible degree on the day of the operation; they increased in degree until they reached their maximum on the eighth or tenth day, and then decreased. The authors claim that it is difficult to state from their observations whether this decrease in the latent period and in the duration of the nystagmus is caused by peripheral vasomotor dilatation which retards external refrigeration or by dilatation and relative inertia of the labyrinthine system which requires greater external refrigeration.

These experiments will be continued, and at this time the experimenters are prepared only to state that the production of reflex nystagmus is not due to any one single cause, but that different factors are involved, one of which is vasomotor disturbance.

Buys [28] reports several cases in which a phenomenon of nonreversibility of the nystagmus occurs after cold irrigation; the head inclined 180 degrees from the first optimum position. The reaction usually noticed after irrigation with cold water, with the head in Bruning's first optimum position (face upward), is nystagmus in the direction opposite

27. Lannois and Gaillard: Rev. de laryngol. **47**:8 (Jan. 15) 1926.
28. Buys: Ann. d. mal. de l'oreille, du larynx. **45**:648 (July) 1926.

the irrigated ear, and changes in the direction of the irrigated ear, when the head is inclined 180 degrees from the first position (face toward floor). The nonreversibility of the nystagmus on inclination of the head might be explained by persistence of the primary nystagmus obtained in the ordinary position and would in that case be due either to a hyperasthesia of the reflex or to the impossibility of bringing about a reverse current in the endolymphatic canals (caused by a congestive condition).

Buys thinks that the simplest way to explain these facts of nonreversibility is to attribute to cold irrigation the power of paralyzing more or less completely the nerve supply of the crests of the ampulla. Thus is created a heterolateral nystagmus constant in all positions of the head, which would be substituted for the ordinary nystagmus for movement of the lymph in case of total abolition of the latter, or which would simply modify it if it were only partially abolished.

ROTATION TEST

Grahe [29] devised a method of palpating nystagmus after slow turning, the principles of which are somewhat old but which hitherto has been unused. The author makes systematic use of this method. He found that regular nystagmic oscillations can be felt, varying from two to five or seven on slowly turning 90 degrees. He says that conclusions cannot be drawn from the number of oscillations, but that they can be drawn concerning the excitability by comparing the two sides, as vestibular patients with unequal excitability of the two sides always show unequal movements of nystagmus oscillations during right and left rotation. The subject is placed before the examiner, who grasps the subject's head from the sides and lays his thumbs lightly on the inner angles of the eyes, his elbows resting on the patient's shoulders. Grahe feels that this is an extremely sensitive test and should be preferred to the others, or at least tried first if other methods are used If the other methods are used first, they will cause different kinds of stimuli and inhibitions so that his test will fail. Sources of error, such as reflexes of the neck and of the pelvis, also voluntary inhibition of nystagmus or inhibition by contraction of eye movements, should be excluded. He gives a detailed description of the method of exclusion.

As to the results of this method, when the vestibules are normal, the number of oscillations are the same on rotation to the left and to the right. The patient must be turned slowly with a little pause after each turn; quick and irregular turning produces irregular nystagmus oscillations. When there is an acute inflammation, there are more oscillations on turning toward that side than toward the other; this is to be inter-

29. Grahe, Karl: Ztschr. f. Laryngol., Rhinol. **14**:369 (July) 1926.

preted as showing an irritated condition of the labyrinth. When the inflammation has persisted for some time, there are fewer oscillations on turning toward that side than toward the other (injury of function). In certain disturbances of the nervous system, if irregular and inhibited nystagmus is palpated on one side and regular on the other, it is safe to conclude that rotation toward the diseased side causes the irregular nystagmus.

LABYRINTHINE PHENOMENA—CLINICAL REPORTS

Reys [30] had a case of conjugated deviation of the head and eyes under observation for some time and made several tests of the vestibular apparatus. The study was made for the understanding of the associated eye movements, particularly, the influence of the labyrinth on the ocular movements and its relation with the higher centers. Autopsy was obtained in this case, and a large hemorrhage between the external capsule and the lenticular nucleus was found. Reys states that the two phases of nystagmus are caused by different reflexes; the slow phase by a vestibulo-ocular reflex, the rapid phase by a vestibulo-lenticulo-ocular reflex. A lesion of the lenticular nucleus inhibits the latter reflex and results in a hypertonia of the labyrinth with a deviation of the eyes toward the side of the hypertonic labyrinth.

Mauthner [31] reports on a case of vertical divergence (Hertwig-Magendie's eye movement). There has been a great deal of physiologic and experimental research on vertical divergence, but few clinical cases have been reported. Tschermak thinks that this divergence is due to lesions of the vestibular nucleus and the paths leading from it to the eye muscle nuclei. The author describes it in a case of hysteria in a girl, aged 18. On irrigation of the right ear with water at room temperature, after a latent period of only a few seconds, there was a deviation of both eyeballs to the left, while the right eyeball turned upward and the left turned downward and remained in this position for a little while (Hertwig-Magendie's symptom). When a test was made several days later, the symptom was not present. In his opinion, there are two groups of these cases. In one, brain injury or disease is sufficient to cause the symptom, while in others, a peripheral labyrinthine stimulus is necessary in connection with the brain injury, or the peripheral stimulus alone may cause it as in the present case. The labyrinthine stimulus here brings about vertical divergence of the eyes by way of the central vestibular and eye muscle nuclei as the labyrinthine stimulus does on change of position of the labyrinth in fish, or stimulation of the one

30. Reys, L.: Rev. d' oto-neuro-ocul. **3**:789, 1925.
31. Mauthner, O.: Monatschr. f. Ohrenh. **59**:1177 (Nov.) 1925.

remaining labyrinth in rabbits after unilateral exclusion of the other labyrinth. When vertical divergence is seen in man and animals after injuries of the cerebellum or other parts of the brain that are related to the vestibular nucleus, it is probably because of permanent or temporary loss of function of inhibiting centers, which allows the original reflex to become manifest.

Messing [32] describes four clinical cases of dissociation of the vestibulo-ocular reflexes, two of tumors of the left cerebral peduncle, one of nonsuppurative encephalitis of the pons and one of cystic glioma of the cerebellum. Normal lavage of the ear with cold water causes horizontal and rotary nystagmus of the opposite side, while irrigation with hot water causes a nystagmus to the side of the ear stimulated. The functional impotence in these cases was particularly in the internal rectus, although symptoms to indicate isolated paralysis of this muscle were absent. A paresis of this muscle during the caloric test can be explained only by a partial lesion of the path leading from the labyrinth to the internal rectus of the opposite side, while the path from the labyrinth to the external rectus of the same side remains intact; that is, the condition was a dissociated paralysis of the vestibulo-ocular reflex, or, more accurately, a dissociated paralysis of the slow component of the caloric nystagmus. This symptom indicates that the morbid process was localized in the posterior longitudinal fasciculus through which the nerve fibers of this reflex pass.

Malan [33] was unable to confirm Kish's opinion that a strong auriculopalpebral reflex is to be regarded as a general neuropathologic symptom. Kish's auriculopalpebral reflex and tear reflex have been known to otologists for some time. Kish merely attempts to individualize the reflex. This reflex is a closing of the lid; more rarely, it is also an inclination of the head toward the irritated side and a flow of tears after touching the wall of the inner part of the external auditory meatus and in the tympanic membrane.

Goldstein [34] described different observations on the so-called induced tonus phenomena in four patients, such as divergence of the legs and spreading of the arms, extension of the right arm and finger on forced voluntary opening of the mouth, etc. The phenomena of inductions on sensory regions and the mutual reactions of sensory and motor processes on each other are then discussed. In injuries of the cerebellum the sense of localization is changed so that spots touched on the skin are localized incorrectly in the same direction as the tendency to deviate

32. Messing, S.: Encéphale. **20**:723 (Dec.) 1925.

33. Malan, Arnaldo: Arch. Internat. de laryngol. otol. and rhinol. et broncho-oesophagoscopie **4**:425, 1925.

34. Goldstein, K.: Deutsche. Ztschr. f. Nervenh. **89**:72, 1926.

in the pointing experiment. This change also extends to the localization of sound. This deviation in keeping with the pointing experiment in cerebellar diseases also acts on sensory processes, and optical, tactile and acoustic localization are changed by it. Goldstein demonstrates that such deviations can be brought out in normal persons under certain circumstances, but are by no means constant.

Schlander [35] describes eleven cases of what he calls symptomless exclusion of the labyrinth, that is, obliteration of function of the labyrinth without symptoms. A study and comparison of these cases show that the course of the inflammation decides whether the exclusion of the labyrinth will cause symptoms or not. The central mechanism which regulates balance can compensate for the loss of peripheral function only when the inflammation progresses slowly and uniformly. The same is true of loss of function of the vestibule due to noninflammatory causes, for example, exclusion of the labyrinth in syphilis. The reason for this is the slow and gradual destruction of the nerve.

TESTS FOR OTOLITH DISTURBANCE

Tweedie,[36] who has been foremost in introducing the work of the Utrecht physiologists to English otologists, and who continues to labor arduously in this field of investigation, presented before the Section of Otology of the Royal Society of Medicine, the method which he had adopted as a ready way of testing the otolith reactions. He wants to have it understood that in view of the present knowledge concerning the structure, this method is offered as a provisional working routine.

> With the patient sitting in the chair with the head erect, the presence or absence of nystagmus is first observed and the vertical and horizontal "pointing" reaction noted. The patient's head is then laid to the right shoulder, and after some 30 seconds, an examination is again made as regards the nystagmus, and then the vertical "pointing" again tested while the head is still in this position. The head is then laid on the left shoulder, and a similar examination repeated. Finally, the head is laid backwards, and after 30 seconds (which must be always observed as the latent period for the reaction in these tests) the effect on the eyes is again examined for nystagmus, and, with the head in this position, the effect on the horizontal pointing noted. If, then, any nystagmus or error in "pointing" were induced, the patient could be tested again, lying on a couch in various positions, while the head and body were maintained in their normal relationship, and thus the potential factor of a neck reflex eliminated or determined.

Thielemann [37] gives excellent reports on the symptoms which he considers are caused by diseases in the region of the otolith apparatus. A comprehensive discussion of each reaction is given, and this author

35. Schlander, E. L.: Monatschr. f. Ohrenh. **59**:1289, 1925.
36. Tweedie, A.: J. Laryng. & Otol. **41**:48 (Jan.) 1926.
37. Thielemann: Ztschr. f. Hals-, Nasen-u. Ohrenh. **13**:557 (March) 1926.

also emphasizes the value of examining the otolith apparatus as well as the semicircular canals in any case of dizziness. This article has been thoroughly reviewed by Amberg in the ARCHIVES, July, 1926.

THEORIES OF LABYRINTHINE TONUS

Wittmaack,[38] in a long serial article, reaches the conclusion that the cuticular formations of the internal ear can no longer be regarded as rigid structures, as they undergo changes in volume, so that one may speak of a special tonus. It may now be assumed that there is a direct connection between the sensory cells and the Corti membrane, on the one hand, while on the other hand, the demonstration of a certain turgescence in this structure justifies the conclusion that the sensory cell apparatus in the Corti membrane, as well as the macula and crista, also possesses a certain tone. As the macula and crista are maintained by the degree of turgescence of the Corti membrane and by the probably directly dependent hydraulic pressure within the fluid-containing space adjoining that of the epithelial margin which is shut off from the fluid in the cochlea, this intramembranous and intra-epithelial pressure, as in the case of the macula and crista, must maintain equilibrium with the pressure of the fluid in the duct of the cochlea. Wittmaack will endeavor to show that the tonus may be influenced in one way or another, and that it will be recognizable through morphologic changes.

Hubby [39] has an interesting theory for the production of labyrinthine tonus. He believes that the cerebrospinal fluid pressure, which is constantly changing, due to heart systole, expiratory phases of respiration, muscular actions, cough, changes of position and other causes, is transmitted by way of the perilymph and the endolymph through two channels into the internal ear in such a manner as to produce stimuli to the vestibular nerve end-organs sufficient to produce all labyrinthine tonus. An excellent diagrammatic sketch is given showing the fluid pathways of the labyrinth and connections with the cerebrospinal fluid.

Szasz [40] describes the vasomotor system in its relation to the ear. He first discusses the recent publications on the innervation of the blood vessels and then the vasomotor phenomena in the middle and internal ears. He states that there are many causes for a vasomotor disturbance in the ear; it may be due to disturbances of internal secretion or metabolism, to autointoxication variations in blood pressure or to endarteritic processes.

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38. Wittmaack, Karl: Arch. fur Ohren-Nasen-und Kehlkopfheilkunde, **114**:278 (Feb.) 1926; ibid. **115**:1 (March) 1926.

39. Hubby, Lester Mead: Labyrinthine Tonus and Variations in Intracranial Pressure, Arch. Otolaryng. **3**:429 (May) 1926.

40. Szasz, T.: Internat. Zentralbl. f. Ohrenh. u. Rhino-Laryngol. **23**:315, 1925; Ztschr. f. Hals-, Nasen-u. Ohrenh **14**:237, 1926.

Szasz calls the vessels of the internal ear buffer vessels and regards them as a fine apparatus which guarantees uniformity in pressure in the internal ear and therefore undisturbed function. A fine vasomotor arrangement compensates for decrease in pressure, but dilatation of these buffer vessels cause a rise in pressure by a constriction. Szasz performed animal experiments to determine to what extent intracranial pressure and blood pressure are capable of causing a change of pressure in the internal ear. He gives a prolonged description of the experiments, which are technical, and brilliantly performed. Parts of his experiment tend to support Shambaugh's theory that labyrinthine pressure is caused by those movements of the endolymph which are produced by transmission of the pulse pressure. These experimental demonstrations of the transmission of pressure variations to the internal ear seem to justify the theory of a compensating regulatory apparatus, and it is probable that the buffer vessels represent the finer part of it.

SEASICKNESS

Abels [41] believes that the determining factor in the production of seasickness is the unusual stimuli coming from tactile and kinesthetic sensations chiefly from the vestibule and the unusual nature of the individual elements of sensation—the short unit of time in which they occur and the peculiar form in which they are combined to form complexes of sensation and also the passive nature of the way in which these stimuli are produced, independent of muscle action. In ordinary conditions, the line of gravity of the body is perpendicular to the surface of the ground, and its lower point lies in the surface on which the body is supported; but in rapid movement, what the author calls a "dynamic line of gravity" is established. For instance, when a runner is just starting a race, his body is at an angle of perhaps 45 degrees from the vertical; yet he does not fall. This is because of an adjustment to his movement of locomotion, and such an adjustment has to be brought about in order to prevent seasickness; the chief task of the centers which maintain balance lies in this adjustment.

Biehl [42] capably states his views on seasickness after having studied this troublesome malady by making a voyage during the stormy period of the year.

It is obvious, with publications on this subject by such eminent men as Ruttin, Wojatschek, Bárány, Spira and Kobrak, all of whom expressed the opinion that the cause of seasickness must be looked for in the vestibular apparatus, that this is the most general opinion.

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41. Abels, Hans: Monatschr. f. Ohrenh. **60**:158 (Feb.) 1926.
42. Biehl: Acta Oto-laryng. No. 9, 1926.

Professor Biehl relates interesting cases and comes to the conclusion that not only the labyrinth but all the other organs of the body are irritated by the ship's movements. He believes that seasickness is produced by pressure, during the ship's motion, more particularly to the pedunculum cerebri and cerebellum; he gives an excellent anatomic as well as physiologic basis for his belief, especially concerning the cisterns and subarachnoid sinuses. He concludes that the cause for seasickness lies in the apparatus centralis—in the brain, and not only in the vestibular apparatus.

News and Comment

NATIONAL SOCIETY MEETINGS

American Laryngological Association, Atlantic City, May 23-25, 1927. President, Dr. Chevalier Jackson, Philadelphia; secretary, Dr. George M. Coates, 1721 Pine St., Philadelphia.

American Laryngological, Rhinological and Otological Society, Atlantic City, May 26-28, 1927. President, Dr. Burt R. Shurly, Detroit; secretary, R. L. Loughran, 33 East 63rd St., New York.

American Ophthalmological Society, Quebec, Canada, June 27-29, 1927. President, Dr. William Zentmayer, 1506 Spruce St., Philadelphia; secretary, Dr. Emory Hill, Professional Bldg., Richmond, Va.

American Academy of Ophthalmology and Oto-Laryngology, Detroit, September 12-16, 1927, Book-Cadillac Hotel. President, Dr. Edward C. Ellett, Exchange Bldg., Memphis, Tenn.; secretary, Dr. L. C. Peter, 1529 Spruce St., Philadelphia.

LOCAL SOCIETY MEETINGS

COLORADO: The Colorado Oto-Laryngological Society meets on the first Saturday of the month from October to May, at the Assembly Room of the Metropolitan Building. President, Dr. David A. Strickler; secretary, Dr. C. Howard Darrow, Metropolitan Building, Denver.

ILLINOIS: The Chicago Laryngological and Otological Society meets at 6 p. m. on the first Monday of the month from October to May, in the Grill Room, Stevens Restaurant, 16 N. Wabash Ave. President, Dr. Arthur M. Corwin; secretary, Dr. Austin A. Hayden, 25 E. Washington St.

MARYLAND: The Section on Otology and Laryngology of the Baltimore City Medical Society meets at 8:30 p. m. on the last Friday of each month, at 1211 Cathedral St. Chairman, Dr. Edward A. Looper; secretary, Dr. Edwin N. Broyles, 1100 N. Charles St.

MISSOURI: The Kansas City Eye, Ear and Nose Society meets the third Thursday of each month from September to May. The November, January and March meetings are devoted to clinical work. President, Dr. Joseph W. Kimberlin; secretary, Dr. A. E. Eubank, 636 Argyle Bldg.

NEW YORK: The Section on Laryngology and Rhinology of the New York Academy of Medicine meets at 8:30 p. m. on the fourth Wednesday of the month from October to May, at 17 W. 43d St. Chairman, Dr. John E. Welch; secretary, Dr. Arthur Nilsen, 40 E. 41st St.

The Otological Section of New York Academy of Medicine meets on the second Friday of each month from October to May, at 103d St. and Fifth Ave. Chairman, Dr. J. L. Maybaum; secretary, Dr. R. T. Atkins, 4 W. 53d St.

OHIO: The Ophthalmological and Otolaryngological Section of the Cleveland Academy of Medicine meets on the fourth Friday of each month at the Winton Hotel. Chairman, Dr. W. J. Abbott; secretary, Dr. A. L. Stotter, 1148 Euclid Ave.

PENNSYLVANIA: The Section on Otology and Laryngology of the College of Physicians of Philadelphia meets at 8:30 p. m. on the third Wednesday of each month from October to June, at the College of Physicians. Chairman, Dr. Fielding O. Lewis; clerk, Dr. James A. Babbitt, 1912 Spruce St.

WISCONSIN: The Milwaukee Oto-Ophthalmic Society meets at 6:30 p. m. on the third Tuesday of the month, at the University Club. President, Dr. Charles J. Coffey; secretary-treasurer, Dr. Edward R. Ryan, 425 E. Water St.

Abstracts from Current Literature

Ear

A Case of Primary Diphtheria of the Outer Ear. Cornelius Veits, Ztschr. f. Hals-, Nasen- u. Ohrenh. **16**:33 (July 31) 1926.

The author describes a case in point. A woman, aged 41, had had a furuncle in the outer canal of the left ear which had been incised Jan. 5, 1925. The patient again came to the clinic one week later. The area of the former abscess, which reached to the concha, was reddened and swollen. During the next days the eczema spread to the outer and posterior portion of the auricle and toward the angle of the jaw. Grayish brown-black crusts had formed; the rest of the canal was filled with a grayish white mass. After one week, the corium and the cartilage at the helix and tragus were laid bare. On February 15, fetid pus was present. The operation of removing a crust led to excruciating pain and hemorrhage. Nine days later, the patient received 0.45 Gm. neoarsphenamine intravenously.

In 1909, the patient had attempted to commit suicide by swallowing numerous needles, and a laparotomy had been performed at that time. The patient said that on Dec. 30, 1924, she had scratched the ear with a needle, and that a child had pushed her which had caused the needle to enter the canal. In November, 1925, three needles could be seen in the roentgenogram. On November 24, two whole needles were removed. The one in the throat was covered by the external jugular vein; the outer end of the other was in the sternocleidomastoid muscle. The disease lasted more than six months, while cases described so far had a duration of only from two to eight weeks. The unfavorable tendency to heal was probably a consequence of angioneurosis. Three relapses occurred on the left side. Later, otitis externa developed on the other side also, with grayish white pseudomembranes and violent pain. The pain disappeared almost immediately after a dose of 2,000 units bovine diphtheria serum had been given. Within twelve days, five additional injections were given. The patient suffered from hysteria and vasoneurosis.

Veits states that diphtheria of the outer ear canal develops from the middle ear, or follows an injury or another inflammation (Kraussold, Gruber, Baginsky). The infection through foreign bodies has not been described so far. Perhaps the patient, who was a carrier, had infected the needle by moistening the thread while sewing. It was difficult to influence the process therapeutically. Acriflavine was used. Diphtheria serum was applied subcutaneously. Neo-arsphenamine, permanganate of potassium and mercurial ointment were used. Acriflavine and diphtheria serum, applied locally, seemed to be ineffective. Diphtheria serum used parenterally was of surprising effectiveness, especially at its first application. The pain disappeared immediately, and most of the membrane could be removed the next day. Healthy granulations appeared, so that at first two injections appeared to control the process, but this was not the case. As anaphylactic symptoms were feared at the next relapse, the serum was used locally but without result. An injection of a flavine dye was also without result. When the process appeared on the other ear, bovine diphtheria serum was used. The pain disappeared promptly, while the objective picture was scarcely changed. This relief from pain is caused by the serum without influencing the fever and other symptoms in diphtheria of

the middle ear and of the external auditory canal, and this has also been observed by Daae. In similar cases larger doses might be recommended. A larger dosage of bovine diphtheria serum could not be obtained for the patient. Permanganate of potassium and especially mercurial ointment (Hilgenreiner) seemed to have a decidedly favorable influence on the fetid odor.

CHRONIC OTITIS MEDIA IN 1911-1921, AT THE UNIVERSITY EAR CLINIC IN FRANKFURT ON THE MAIN. STERN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **16**:162 (Sept. 22) 1926.

During the years 1911 to 1921, 5,380 patients suffering from chronic middle ear suppuration (71.3 per cent) were observed, compared with 2,160 patients (28.7 per cent) who suffered from acute middle ear suppuration. In consequence of the war, the number of patients was larger in the years from 1914 to 1919 on account of such factors as injuries to the ear and undernourishment. There were three and one-half times as many male as female patients. Most cases occurred during the second and third decades, while in acute otitis media most cases occur during childhood. With the exception of infectious diseases, in 3.7 per cent of cases, the cause of chronic otitis media is difficult to establish. It must be assumed that the disease will be chronic from the beginning, although it must be admitted that in the development of mesotympanal disease, changes in the nasopharynx play an important rôle. In 0.65 per cent, tuberculosis could be shown; in 59.9 per cent, diseases of the nasopharynx, of the nose and of the nasal accessory cavities were found. Chronic otitis media is classified as mesotympanal in 56 and epitympanal in 27.8 per cent of cases. Both forms were present in 7.8 per cent. In 8.4 per cent, the localization of the perforation was not mentioned. The symptoms were discharge, then headache and pain in the ear, followed by difficulty in hearing. In 54 per cent of the patients sound conduction was impaired and in 6.7 per cent sound perception. Both were impaired in 36.1 per cent. Vestibular hypoexcitability was present in 19.6 per cent, vestibular hyperexcitability in 6.9 per cent. Three and a half per cent reacted differently calorically and after turning. With seven exceptions, leading to a mastoid operation, the mesotympanal middle ear suppuration was treated conservatively. Of the epitympanal cases, eighty-seven patients (18.1 per cent) were treated conservatively; 3913 (81.9 per cent) were treated surgically — of these, 75.1 per cent underwent radical operations and 24.9 per cent attico-antrotomies. Forty-seven mesotympanal and fifty-one epitympanal suppurations were associated with mastoiditis, which in seven mesotympanal and in all epitympanal cases led to an operation. Thirty-one times a facial paresis was noticed, twenty-one times before and ten times after the operation. In forty patients an extradural abscess was found during the operation. Seventy-five per cent of these were cured. In sixty-one patients, a labyrinthitis developed. Of these thirty-two had a fistula of the semicircular canal, and of these eighteen had a symptom of fistula. A complete labyrinth operation was performed on eighteen patients, a partial operation on one patient. Six (31.6 per cent) died; thirteen (68.4 per cent) were cured. Of those who had not been operated on, ten (23.8 per cent) died; all others (72.2 per cent) were cured. In six patients a sinus thrombosis was found; five of these patients (83.3 per cent) died of further ear complications. Seven abscesses of the brain were observed, four of the cerebrum and three of the cerebellum. Three patients suffering from abscesses of the brain died. In seven patients, a meningitis serosa was present. These patients recovered.

In sixteen patients, a suppurative meningitis was found. Six of these patients, 37.5 per cent, recovered. In all, twenty-three patients died, seventeen of whom, 0.31 per cent, died on account of an ear disease.

STREPTOCOCCUS VIRIDANS IN PURE CULTURE IN THE SPINAL FLUID IN OTOGENOUS ABSCESS OF THE BRAIN AND IN MENINGITIS (A POSTSCRIPT TO "SENSORY APHASIA IN OTOGENOUS EXTRADURAL ABSCESS IN THE LEFT MIDDLE CRANIAL FOSSA"). H. THORMANN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **16**:322 (Sept. 22) 1926.

In the *Zeitschrift für Hals-, Nasen- und Ohrenheilkunde* (ii [eleven] part 4, 1925), the author reported a case in point. The patient had been discharged as cured on Oct. 13, 1924. On Oct. 31, 1925, the patient presented himself again and said that the ear, which had been operated on, had begun to discharge again four months after he had left the clinic. For two weeks he had felt weak, had had no appetite, had not slept well and had had dull pain on the left side of the head. The temperature on admission had been 101.3 F. The wound was reopened, but not the dura. The next morning the patient vomited; the temperature was 99.9 F., the pulse rate 46. The neck was stiff; amnesic aphasia was present. In the evening, the temperature rose to 103.6 F., the pulse rate to 66.

The spinal fluid was clear. The stiffness of the neck increased, and the Kernig sign was present. The dura was incised, and foul pus was found by aspiration at a depth of 4 cm. The opening was enlarged and a fenestrated cannula was introduced (Koerner). The patient died. The question arises whether the abscess of the brain was caused by the extradural abscess or by the relapsing middle ear suppuration (cholesteatoma). Necropsy was not permitted. The examination of both specimens of the spinal fluid showed the presence of *Streptococcus viridans* in pure culture. There are no reports in the literatures concerning the fate of patients who apparently have been cured after operation for an extradural abscess with speech disturbances.

Besides the cases of extradural abscess with sensory disturbances of speech reported by Alexander, Brunner, Lorenz, Merkens, Moulonguet, Pritchard and Salzer, additional cases have been reported by A. Jansen, Boenninghaus, W. Jansen, Rudloff and Buech.

AMBERG, Detroit.

Pharynx

TECHNIC OF TONSILLECTOMY IN CHILDREN. PAUL OHNACKER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **16**:420 (Oct. 1) 1926.

The dangers of a general anesthetic can be avoided if all precautions are observed. Well trained assistance is necessary in tonsillectomy performed either with the patient in the sitting position or by using a kind of suspension laryngoscopy. Complete extracapsular enucleation can be obtained also in other ways. In the clinic in Magdeburg, more than a thousand tonsils have been removed, according to Sluder. The tonsillectome works best if it is not too sharp or too dull. When ethylchloride anesthesia is used with the drop method, the Whitehead mouth speculum is introduced. Sluder's tonsillectome, over which a Bruening sling has been placed, is introduced according to the rule of the author, and the tonsil is pressed through the opening. Then the blade is pushed forward. The moment that the capsule is seen, Sluder's tonsillectome has done its duty as a cutting and separating instrument. The

tongue depressor can be laid aside. The enucleation of the tonsil is quickly but carefully performed with the finger (a rubber glove is used and over it a cloth glove). As the capsule is exposed, the right layer cannot be missed. Extracapsular enucleation is easy, because the closed Sluder tonsillectome holds the tonsil and keeps the connection with the base stretched. Fixation and stretching is important. Severing of the palatine arch along its anterior border does not have any disadvantages; on the contrary, it is advantageous because it allows a good view. The plica supratonsillaris is severed and the supratonsillar fossa is opened. The upper pole is made accessible. Sometimes the severing of the palatine arch cannot be avoided. Sluder himself states that a small part of the anterior palatine arch—a few fibers of the palatoglossal muscle—can be seen in the removed specimen. The author asserts that his method is superior when using general anesthesia, which is necessary in children, on account of the rapidity and simplicity of performance.

AMBERG, Detroit.

Larynx

PATHOLOGIC ANATOMY AND PATHOGENESIS OF LARYNGEAL TUBERCULOSIS. PETZAL, Proc. German Otolaryng. Soc., Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:95 (Nov.) 1926.

In case 1, tubercle of the epiglottis, less than twenty-four hours old, serial sections were necessary to show giant cells and epithelioid cells; necrosis was demonstrated in a few sections. Early tuberculosis of the larynx may be difficult to diagnose. In doubtful cases serial sections may be necessary. A discussion without conclusion follows as to whether infection was by sputum, blood or lymph channels.

In case 2, the patient was a young man who had had laryngeal tuberculosis over a period of years with unchanging thickening of ventricular bands and infiltration of the posterior wall. Biopsy showed a subepithelial tubercle differing only slightly from the recent one described above.

The specimen in case 3 was from a young man who had an apical infection and hoarseness, but whose case was favorable clinically. Section from the larynx showed a true fibrosis of the kind described by Mannasse as occurring in young people with good resistance. The tubercles consisted of epithelioid cells and lymphocytes; giant cells and necrosis were not observed; the tubercles were surrounded by fibrous tissue. This histologic picture is of good prognosis. Nevertheless, three days after excision there was a marked increase both in the throat and lung symptoms, with high fever and death in a few weeks. This case shows that in spite of supposedly favorable histologic observations, the physician must be guarded in making a prognosis.

LEUCOCYTE BLOOD PICTURE AND SEDIMENTATION TEST IN THE TREATMENT OF LARYNGEAL TUBERCULOSIS. VOGEL, Proc. German Otolaryng. Soc., Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:97 (Nov.) 1926.

This article gives a detailed analysis of parallel differential leukocyte counts and cell sedimentation tests in thirty-four cases of laryngeal tuberculosis, with discussion of the opinions of numerous writers on these tests. The author's conclusions are that relative neutrophilia is as good an index of activity in the tuberculous process as are temperature and weight curves. On the other hand, neutropenia with lymphocytosis and eosinophilia are good omens. The

rapidity of cell sedimentation is in the main parallel with neutrophilia and of the same significance, and these two tests together are a good guide in the treatment of tuberculosis.

TUBERCULOSIS OF THE REGIONAL LYMPH GLANDS WITH CARCINOMA OF THE LARYNX, THROAT AND TONGUE. LEICHER, Proc. German Otolaryng. Soc., Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:123 (Nov.) 1926.

The author reports five cases of carcinoma of the tongue, throat and larynx with a biopsy of the cervical glands showing tuberculosis and not carcinoma. In cases of carcinoma of the throat clinical examination of regional glands is worthless for prognosis, as differential diagnosis between tuberculosis and carcinoma can be established only by biopsy. For diagnosis of the primary tumor only biopsy of the tumor itself is reliable.

THE USEFULNESS OF PHOTOTHERAPY OF LARYNGEAL TUBERCULOSIS. CEMACH, Proc. German Otolaryng. Soc., Ztschr. f. Hals-, Nasen-, u. Ohrenh. **15**: 130 (Nov.) 1926.

The author states that in his hands light therapy has proved a distinct advance in the treatment of laryngeal tuberculosis, but our theoretical knowledge of its action trails behind empiricism. Its application is an art, and favorable cases for its use must be selected carefully. The general sunbath, whether natural or artificial (carbon lamp or quartz lamp), which produces such wonderful results in bone and joint tuberculosis is often dangerous in lung and laryngeal lesions. Some patients with laryngeal tuberculosis who are harmed by general light therapy are benefited by local application alone. The author considers light therapy an irritation reaction similar to other irritation reactions, as those following tuberculin; his indications and contraindications for local or general use are based on this view, and he reminds physicians that results are dependent on the resistance and reaction of the individual patient. Acute laryngeal cases he says are best treated with the heat lamp externally, and not with the quartz or carbon lamp. Just as in exudative tuberculosis of the lungs rest, fresh air, diet and climatic conditions are useful, while in cirrhotic processes irritation therapy is useful, so treatment must be adapted to the laryngeal condition. As to the usefulness of a powerful carbon (artificial sun) lamp as against the quartz lamp, he believes that they are equally useful if properly used; he says, however, that the quartz lamp is more convenient, especially in sanitariums, which are likely to be isolated in the country. He also says that more patients will be cured when the idea of treating them all by light alone is given up.

A NEW METHOD OF CAUTERY IN LARYNGEAL TUBERCULOSIS. KRASZNIG, Proc. German Otolaryng. Soc., Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:136 (Nov.) 1926.

The author calls attention to the general acceptance of cautery as a therapeutic agent. He believes a deposit of copper in the tissues in addition is an advantage in that it bestows a local immunity. He adds the copper by having his electrode wrapped with fine copper wire.

DISCUSSION OF ARTICLES ON LARYNGEAL TUBERCULOSIS. Proc. German Otolaryng. Soc., Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:142 (Nov.) 1926.

Dr. Wessely said that in order to determine the effect of local application of light therapy as against general light baths, he treated locally only one lesion or a part of a lesion in throats in which there were several, and he obtained healing in the treated portion while the other parts remained unhealed. The effect of the local application consisted in a marked connective tissue development characteristic of lesions healed by light. He uses a carbon arc light spectroscopically identical with sunlight and of the same strength as zenith sunlight in high mountains.

Dr. Finder said that in compiling statistics of results, it is necessary to note the type of tuberculosis, whether it tends to connective tissue formation and favorable reactions to treatment or not, and the stage of advancement of the disease. In the institution with which he is connected, the mortality in early cases was 5 per cent; during the war, when patients with more advanced cases were admitted, it rose to 40 per cent.

Dr. Zange said that there is danger in roentgen-ray treatment of tuberculosis. When properly used, it is efficacious. In persons of low resistance he had seen death follow a dose of 15 per cent Holzknecht erythema dose.

Dr. Thost said that his experience with roentgen-ray treatment has been unfavorable. He believes that the roentgen ray may have prognostic value in showing whether the process involves bony structures.

Dr. Blegvad said that he was convinced that even in advanced cases local treatment of the larynx, cautery, surgical removal of parts, etc., is valuable in connection with light baths. He quoted from his large material in the Copenhagen tuberculosis hospital.

Dr. Strandberg said that in his experience the cell sedimentation test was not of value in prognosis so far as laryngeal tuberculosis is concerned. He believed it was influenced rather by the lung condition, as the lungs are far more vascular. According to his knowledge of physics of light and its application in contact with tissues in concentrated form (Finsen light), and the impossibility of its application perpendicularly to the larynx in sufficient quantity, he doubts the local results claimed, and reports equally good or better results without the local use of light in the larynx.

Dr. Kobrak said that he believed that local variations of immunity in different tissues must be considered, as well as general immunity. He had had good results with the roentgen ray using from 10 to 12 per cent Holzknecht erythema dose at three week intervals.

Dr. Muehlenkamp said that if the differential diagnosis between laryngeal tuberculosis and catarrhal laryngitis cannot be made by any other method, he vaccinates the patient with tuberculin (Ponndorf). If the patient reports a definite subjective improvement, the process is tuberculous; otherwise not.

Drs. Loebell and Brueggeman recommended immobilization of the arytenoids by alcohol injection of the recurrent laryngeal nerve.

Dr. Koerner called attention to the old established method of putting the larynx at rest by tracheotomy in well selected cases.

Dr. Leicher reported a case of tuberculosis of the epiglottis and on the anterior pillar of the fauces. That of the pillar, because it was accessible, received 10 Kromayer lamp treatments, without benefit, while the epiglottis lesion healed without local treatment with the lamp.

Dr. Cemach said that he still believed that tuberculin in proper form in selected cases was the best treatment, but he thought the local light therapy of value, although he did not expect certain results. He indosed Vogel's observation of the prognostic value of the sedimentation test. Practical results rather than theory must be the guide for the present.

LEWY, Chicago.

CLINICAL AND PATHOLOGIC ANATOMY OF PERICHONDRITIS OF THE CRICOID CARTILAGE. WILHELM HAARDT, Ztschr. f. Hals-, Nasen- u. Ohrenh. **16**:184 (Sept. 22) 1926.

The author reports two cases with necropsies and gives a description of histologic specimens, one of his own and one of Hajek and Erdheim. Eppinger has discussed the pathologic anatomy of perichondritis of the larynx. The disease progresses more quickly in ossified cartilage than in cartilage proper. The cartilage has no vessels and can be attacked only from the outside. It is more resistant than the tender, spongioid bone, rich in marrow. The inflammation first attacks the cricoid cartilage. In one patient the tracheal cartilage also was affected. The arytenoid cartilage was injured most; the surrounding soft parts and the muscles of the larynx also showed grave disturbances. In a spontaneous cure, the abscess cavity is filled with shrinking connective tissue. If the defects of cartilage are small, regeneration may occur, as Zarfl has shown.

INTRATRACHEAL PRESSURE UNDER NORMAL AND PATHOLOGIC CONDITIONS. F. HASSLINGER, Ztschr. f. Hals-, Nasen- u. Ohenrh. **16**:302 (Sept. 22) 1926.

If the previous sources of error were avoided, the pressure during inspiration through a normal larynx of the adult was from 6 to 9 mm. of water, and during expiration from +6 to +9 mm. of water. In stenoses of the larynx, changes in pressure as a rule increase evenly during inspiration and expiration, yet in some instances when the larynx is closed, valvelike, the pressure during inspiration exceeds markedly the pressure during expiration. The pressure during which the feeling of dyspnea occurs varies with different persons. In the same person, with the same intratracheal pressure, dyspnea may be present in acute stenoses and may be absent in chronic stenoses. During swallowing, as a rule, a slight increase of intratracheal pressure occurs (from +25 to +82 mm. of water). Patients who had been subjected to a tracheotomy and who did not swallow correctly seem to prove that lack of closure of the respiratory paths during swallowing cannot be made responsible per se for swallowing the wrong way. The intratracheal pressure during forced expiration with a closed glottis (compression) amounts to from +82 to +106 mm. of mercury and is equal to the pressure in Valsalva's experiment. The pressure values during compression in the Valsalva experiment vary at times with the same person. Average values of pressure while coughing vary in adults from +256 to +384 mm. of mercury. The cough pressure decreases considerably in cases in which there is incomplete closure of the larynx; for instance, in paralysis of the recurrent nerve, or when the expiratory forces do not work well, as when pain is present during coughing. If a communication exists between the trachea and the outside, for instance, after tracheotomy, the cough pressure is diminished to about one-third. If circumstances are favorable, those who use cannulas can develop an emphysema even if the cough pressure is diminished, because a pressure of only from +26 to +28 mm. of mercury is necessary to cause a subcutaneous or mediastinal emphysema. Inspiration with occlusion of the mouth and nose (Mueller's experiment) leads to a

negative pressure of from —44 to —72 mm. of mercury. In single cases, the pressure values in Mueller's test are somewhat smaller than the positive values during Valsalva's test. The momentary decrease in pressure while the patient is snuffing amounts to from —42 to —66 mm. of mercury. It is somewhat less than in Mueller's test. With the same person, a certain fixed relation exists, as a rule, between the positive values during compression and cough in Valsalva's test. High and low values in the first correspond with high and low values in the latter. High and low positive pressure values during Valsalva's test and during cough correspond almost always with respective high and low values in Mueller's test or in snuffing.

PHYSIOLOGY AND PATHOLOGY OF MOBILITY OF THE LARYNX. J. WELEMINSKY, Ztschr. f. Hals-, Nasen- u. Ohrenh. **16**:374 (Oct. 14) 1926.

Most authors think that the mechanism which leads to the closure of the glottis serves, primarily for the production of tones. In reality, the original function of the larynx which is indispensable to life is the closure of the respiratory tract during swallowing, vomiting, pressure and cough. Tone production is secondary. If it is assumed that the posterior muscle alone causes the dilatation of the larynx beyond the cadaver position, and that the cricothyroid muscle may be the most essential factor in closing the glottis, then if the recurrent nerve is progressively injured in all its fibers, at a certain moment all muscles controlled by it will not receive the impulse necessary to overcome obstacles. Thus the dilatation which is caused by the posterior muscle will cease. The constrictors will also cease to function if the intact cricothyroid muscle does not function, so that closure of the glottis remains normal until the constrictors become unable to act in spite of assistance. With certain changes in wording, this corresponds with the meaning of the Rosenbach-Semon law.

AMBERG, Detroit.

Nose

DETERMINATION OF SMELL IN ABSOLUTE VALUES. WALTER HESS, Ztschr. f. Hals-, Nasen- u. Ohrenh. **16**:359 (Oct. 14) 1926.

The author reports the results which he obtained with various odors (fatty acids), in determining the absolute threshold in Gramme-odoriferous substances per cubic centimeter of air, partly with the steam-pressure olfactometer of Hofmann-Kohlrausch, partly by a method of weight determination which is fully described.

Zwaardemaker's olfactometer which is used in the clinic can be gaged with the same in absolute values. Weber's law as a whole could also be confirmed with the aid of the steam-pressure olfactometer.

CORYNEBACTERIA IN THE NOSES OF PATIENTS SUFFERING FROM OZENA. F. V. D. HUETTEN and H. KLIEWE, Ztschr. f. Hals-, Nasen- u. Ohrenh. **16**:408 (Oct. 14) 1926.

1. *Corynebacteria* were found in the noses of forty-three patients suffering from atrophic rhinitis with and without odor; twenty-one stocks (49 per cent) of the group di-b, and twenty-two (51 per cent) of the pseudodi-b.

2. Among the twenty-one di-stocks, seven were typical di-stocks pathogenic for animals (group *I b*), and five stocks belonged morphologically and bio-

logically to group *I a* or *I b*. Animal experimentation was not made with these. Three stocks (group *I c*) were in a separate class. They did not form an acid from maltose and were not pathogenic for animals.

3. The twenty-two pseudodi-stocks could be subdivided into four different classes according to their biologic behavior on litmus sugar culture mediums (maltose, levulose and saccharose). The sixteen stocks in the first subdivision fermented maltose, levulose and saccharose, but not dextrose. Two stocks, group *II b*, formed acids from maltose and levulose; saccharose and dextrose remained unchanged. The stocks of the last group of the pseudodi-b group *II c*) left maltose, levulose, saccharose and dextrose unchanged.

4. The authors do not consider it essential to determine whether di-bacteria, bacteria resembling di-bacteria or pseudodi-bacteria are found in the nose of patients suffering from ozena, because genuine di-bacteria can acquire the qualities of pseudodi-bacteria.

5. The investigations of the authors, especially the epidemiologic researches, lead to the conclusion that *Corynebacteria* are not a causative factor in ozena.

AMBERG, Detroit.

Miscellaneous

RECURRENT KERATITIS PROFUNDA FROM MAXILLARY SINUSITIS. A. G. WILDE, Am. J. Ophth. **9**:892 (Dec.) 1926.

Wilde reports a case of keratitis profunda which seemed to follow the explosion of a stove, when many particles of coal dust and soot entered the patient's left eye. Soon after this, photophobia with lacrimation and a gradual reduction of vision occurred. The first attack lasted two months, after which the eye became almost normal. In a short time, photophobia, injection, pain and diminished vision returned. The patient has had similar attacks at intervals ever since, in spite of varied treatment.

During two years, following the accident, the patient spent the greater part of his time in government hospitals, and since 1921 the eye had never been entirely normal. For the past year the pupil had been kept widely dilated by atropine, and internal medication had been administered. His tonsils were removed; one tooth was extracted, and the ethmoids and sphenoids were opened in the hope of finding the source of infection, but no visible alteration was noted in the condition of the eye.

Examination of the left eye showed: vision 20/100; Jaeger's test type no. 13 was read with difficulty. The left palpebral fissure was held at little more than slit size. There was severe blepharospasm with a gush of tears when the lids were forcibly separated. The conjunctiva was thickened, with marked hypertrophy of all lymphoid follicles. There was ciliary and scleral injection. Chemosis did not occur. A triangular area of opacity occupied the inner lower quadrant of the cornea, and there were two small depressions over the denser central portions. The eyeball was not markedly tender on palpation. The tension was normal. The pupil was widely but evenly dilated by atropine, and no remnants of iris pigment could be found on the lens.

Within the quadrant-shaped area of opacity, the slit-lamp showed the cornea infiltrated throughout all its layers, but more densely toward the center. A number of deep vessels invaded this area. The infiltrate was diffuse, punctate areas such as are seen in the interstitial form of keratitis not being seen. Deposits were not found on the corneal endothelium or surface of the lens, and evidence that the iris or ciliary body had ever been involved by the process was absent. Examination of the fundus was difficult.

The right eye was entirely normal; vision 20/20 and Jaeger's test type no. 1 was read.

General physical examination did not help to determine the source of the eye irritation. There was moderate pyorrhea, and one tooth was immediately extracted. The Wassermann test was negative.

A middle turbinate had previously been opened on both sides, and crusting and discharge were visible at the former sites. The condition of both maxillary sinuses was questionable on transillumination. A puncture of the right antrum was performed, but as the washing fluid returned through the lacrimal punctum the effort was discontinued. The left antrum was then punctured, and the wash showed a few soft mucous shreds. A later puncture of the right antrum evacuated a small amount of yellow fluid through the needle.

Roentgen-ray examination showed the maxillary sinuses hazy, the degree of opacity not being sufficient for fluid.

Further search for the source of infection was continued. Syphilis and tuberculosis were excluded, and after a month of treatment the eye became white, and vision gradually returned to normal. The patient was discharged without any definite understanding having been reached as to the nature and location of the basic lesion.

The patient took a long automobile ride on a raw and blustery day, and within twenty-four hours was back in the hospital with the eye intensely injected, a large fresh area of corneal infiltration, severe photophobia and pain. The search for the focus of infection was renewed. The right antrum was washed out, a dense coagulum of mucopus being recovered.

On account of the severity and duration of the eye symptoms, radical antrum operation was decided on, and a bilateral operation was performed by Major Robert E. Parrish. The right antrum was found half filled with a soft polypoid mucosa and mucopus. The left antrum had a small amount of soft pedunculated polypus but there were no liquid contents.

During the short but rather stormy convalescence, the eye did not show any reaction. All local treatment was abandoned. The cornea became normal, with the exception of a small vertical line at the lower limbus. With the slit lamp, evidence of the previous infiltration was not noticeable beyond faint outlines of the formerly invading vessels. Vision was normal, and the patient was discharged with the eye entirely normal for the first time since the original attack in 1918.

In summarizing, the author states that the clinically demonstrable evidence of a pathologic condition of the sinus extensive enough to produce an aggravated keratitis profunda may be surprisingly little.

It is preferable to attack one point at a time in searching for focal infections of this nature. When such a focus is found, palliative measures may do little more than stir up the toxin absorption, thus tending to aggravate the distant lesion. The author advises that the entire septic area be eliminated.

VAIL, Cincinnati.

THE BACTERIOPHAGE OF D'HERELLE AND ITS APPLICATION IN OTOLARYNGOLOGY. PIERRE CAMUS, Arch. internat. de laryngol. otol. rhinol. **5**:938 (Sept.-Oct.) 1926.

The author reviews the technic and results obtained by d'Herelle with the Shiga bacillus. Employing the staphylococcus, he applied the bacteriophage clinically in thirty-seven otolaryngologic cases.

It is important to recognize that an antibacteriophage may be developed or may have developed in the person which can defeat the purpose of the bacteriophage. The patient's resistance can also be reduced. The acute and chronic infections of the ear, nose and throat present too many mixed flora to employ the bacteriophage successfully. However, some infections of pure staphylococcus origin are seen by the otolaryngologist, such as circumscribed external otitis, furunculosis, folliculitis of the nose, staphylococcic infection of the tonsils and sycosis.

The treatment is local and general. Local treatment consists in cleansing the part and, when practical, placing tampons of the bacteriophage in contact with the part for twenty-four hours. The tampon should be renewed if necessary. General treatment consists in subcutaneous injections of from 1.5 to 3 cc. of the bacteriophage at intervals of twenty-four hours. The injections should not exceed four, or an antibacteriophage may be produced. The reaction may be local or general, but in the fifty cases observed a marked general reaction did not occur.

The advantages of treatment by means of the bacteriophage are rapid cure, direct local treatment supplemented by general treatment, and the absence of shock. The disadvantages are local reactions observed at the site of the injection in 30 per cent of the cases, also the possibility of a general reaction.

ROTH, Kankakee, Ill.

THE FLORA OF THE TRACHEOBRONCHIAL TREE OF THE LIVING. F. HASSLINGER and H. STERNBERG, Ztschr. f. Hals-, Nassen- u. Ohrenh. **16**:108 (July 31) 1926.

The authors first established the fact that the use of a cocaine-epinephrine hydrochloride solution, which was used as a local anesthetic, was of no influence on microbes, as far as their investigations were concerned. They used a special instrument in order to assure the absence of contamination and found that the larynx and subglottis showed little flora, whereas the deeper parts of the air passages were sterile. In one patient the secretion taken from the larynx also was sterile. In a patient suffering from bronchiectasis, and in a patient who had undergone a tracheotomy, the deeper air passages were not sterile. In the other patients with normal conditions, the trachea and main bronchi were found sterile. These observations agree with the observations of Klipstein on freshly killed animals. According to the work of Klipstein and others, the reason for this circumstance may be that inhaled air has few microbes and that the nasopharyngeal mucus has a cleansing effect. Those microbes which reach the air passages find a poor soil in the tracheobronchial secretion and are expelled by the ciliated cells. Wrozek could show that microbes introduced into the lung perish after from six to seventeen hours.

CHANGE OF VOICE IN BOTH SEXES. H. L. FELLENZ, Ztschr. f. Hals-, Nasen- u. Ohrenh. **16**:426 (Oct. 14) 1926.

Change of the voice is usually known as breaking of the voice. Other forms are rarely considered. The different variations are of importance for later life. Change of voice in the female sex is almost unknown, and is not considered in vocal lessons. In the meridian of Munich, change of voice in boys usually occurs between the ages of 14 and 16 years, with the beginning of puberty. The change may be completed in the fourteenth year (Weinberg)

and may begin in the eleventh and twelfth years (Nadoleczny), and it can be delayed until the twenty-first year (Gutzman). The duration of the period of change of voice may be from a few months to several years. Extensive investigations concerning this change in voice in girls have not yet been made. The change seems to begin earlier in them—from the twelfth to the fourteenth year.

The physiologic process consists of lowering of the pitch on account of the growth of the larynx during sexual development. In the male, the length of the vocal cords increases about one-third, and the voice becomes one octave lower, whereas the higher tones can be produced only with the head voice or not at all. In the female, the growth of the larynx is considerably less; the voice is lowered about a third; therefore the change is more easily unobserved.

The falsetto voice is produced when the musculus vocalis suddenly ceases to function and the musculus externus controls the voice. This does not necessarily occur. It happens in only 17 per cent of the girls (Mackenzie). In 40 per cent of the patients singing is impossible until the fifteenth year. The rough voice is more frequent in the female sex. The vocal cords act as in paresis of the musculus internus. There may be a slight redness of the epiglottis and the vocal cord; it may be absent (in about 10 per cent) or be combined with pronounced edematous swelling (in about 15 per cent). Usually the mucous membrane is more or less soft and swollen and the secretion is increased.

The author gives case histories. The girls examined complained of difficulty in singing or talkng. In all cases, rest and care of the voice is of the greatest importance. Frequently, treatment is necessary to teach the subject how to use the upper chest tones and the middle register of the voice; later, the entire range of the voice may be used, but the high tones may be used only moderately. A number of histories of male patients are given in whom the falsetto voice persisted. The closure of the vocal cords as a rule is imperfect or completely absent at the posterior third. Treatment consists of voice exercises to accustom the patient to the lower pitch. Moderate galvanization or faradization or vibration with tuning forks is recommended. The treatment lasts for from eight days to several months.

The pitch is higher than the normal pitch for the male voice (*a-d*), and is usually within the range of the female speaking voice (*a-d*^{1}) or higher. The chest voice is frequently absent. Treatment tends to accustom the subject to the deep register. This treatment can be made more effective by pressure toward the back on the thyroid cartilage, and moderate use of the pulsating constant current (Flatau) or the faradic current (Imhofer), or vibration with tuning forks (Maljutin and Gutzmann). The patient must take reading and speaking exercises. Fellenz reports thirty-two cases. Case 29 may be mentioned. A woman, aged 20, surprisingly small for her age—she looked as if she were 16 years old—for five or six years, about since the time of puberty, had complained of hoarseness and hawking. There was not any particular pathologic condition of the upper air passages. The vocal cords were short, of medium width and soft and swollen. The veins of the cords were somewhat enlarged; the borders were a little reddened. The patient's voice reached the pitch *a*, whereas, while reading, it reached c^1 sharp, d^1. The patient hawked with each sentence. The chest voice was from *f* to e^1, the middle register of the voice from f^1 to d^2, the head voice reached e^2, f^2 sharp, respectively g^2. The patient had a weak voice and increased secretion. After treatment with insufflations of anesthesin for four weeks, the mucus disappeared from the larynx. The patient had not been allowed to sing or exert her voice. She hawked then only rarely. Fellenz discusses many phases of this subject, of which only a few more can

be mentioned here. Hidden disturbances of the change of voice are almost as common in the female as in the male, and treatment is perhaps more tedious. A falsetto voice is rarely present.

Treatment with caustics or the brush could have been avoided frequently if the voice had been tested. Therefore, in cases of continued hoarseness, the voice should be tested as a routine measure. On the other hand, not every coarse and hoarse voice is caused by functional disturbance. The larynx must also be examined from the outside and with the mirror; otherwise tuberculosis of the larynx might be overlooked. Teachers of the technic of breathing and voice formation have "treated" patients for months, who suffered from tuberculosis of the larynx by exercises of the voice, whereas silence should have been prescribed.

It is important to recognize the disease of the voice mentioned, because children and servants who are chronically hoarse may be suspected of suffering from tuberculosis, and teachers who are suspected of having this disease may be dismissed. Sometimes during the change of voice in the male there is retarded growth of the larynx. The voice cannot be formed in the deep register because this is anatomically impossible. In the female, an unusual change of voice is shown by an abnormally deep voice. Usually an abnormally large larynx is present. Zumsteeg described a base voice in a female vaudeville singer. Scheier reported a base voice in a girl aged 16; it turned into a falsetto voice. Herzog described a case of heterologous pubertas praecox in a girl aged 3 years, whose range of voice was determined by Nadolezny to be between G sharp and *c*.

AMBERG, Detroit.

Society Transactions

COLLEGE OF PHYSICIANS OF PHILADELPHIA, SECTION ON OTOLOGY AND LARYNGOLOGY

Nov. 17, 1926

FIELDING O. LEWIS, M.D., *Chairman*

IS RADIUM A CURE FOR CANCER OF THE LARYNX? AN INQUIRY BASED ON A STUDY OF THE END-RESULTS. Presented by DR. THOMAS J. HARRIS, New York City (by invitation).

After a comprehensive review of the literature on this subject, Dr. Harris reported a series of sixty cases of laryngeal neoplasm in which the patients were treated with radium. Thirty were treated by Dr. Imperatori and thirty by Dr. Harris at the New York Post-Graduate Hospital. In two cases the patients remained for nearly five years. Dr. Imperatori and Dr. Harris concluded from their work with radium that it is not a cure for cancer of the larynx. The use of emanation seeds is yet too new to estimate properly the results obtained by this method of treatment.

The danger of serious after-effects when radium is used in laryngeal neoplasm was discussed. Toxemia following extensive necrosis, stimulation of neoplastic cells and increase of dysfunction of the parts have been observed following the use of radium in this condition.

Dr. Harris had seen suffering increased and death hastened by the use of radium. He, therefore, concluded that radium in the treatment of laryngeal cancer is not only a disappointment, but is harmful. When there is choice in the method of treatment, radium should not be substituted for surgical intervention.

DISCUSSION

DR. H. H. FORBES: In conjunction with Dr. Harris, I have used radium in laryngeal cases since 1908. In benign cases the results have been good, but when malignancy has been present the results have always been unfavorable. Biopsy should be used as a diagnostic measure.

DR. HENRY PANCOAST: I no longer use radium in the treatment of laryngeal cancer except in special cases. Cancer of the larynx is not suitable for radium therapy, first, because of the resistant nature of squamous cell carcinoma which is the type most often found; second, because of the tendency to necrosis of the laryngeal cartilages after the intensive radiation necessary; third, because of the frequently inaccessible position of the growth. Prior to 1924, I had treated thirty patients with radium. Only one of these had a proved case of squamous cell carcinoma. Six of these patients are now living. Operation gives better results in laryngeal cancer than radium therapy.

DR. FIELDING O. LEWIS: I have found that the use of radium in laryngeal cancer makes subsequent surgical intervention more difficult. Since 1919, I have performed 85 total laryngectomies for both extrinsic and intrinsic growths. When the diagnosis is established and the growth can be completely removed,

surgical intervention is the only necessary procedure. Patients with all types of laryngeal carcinoma except the intrinsic type involving the anterior two thirds of the cord should be treated by total laryngectomy.

Dr. G. E. Pfahler: I have never seen a patient in whom the condition has become more severe after radiation. I am more enthusiastic than ever over radium treatment of cancer. One patient whose case was considered inoperable recover following radium treatment. I have not observed the toxemia following treatment referred to by Dr. Harris.

Dr. Harris: I wish to state emphatically that I have seen laryngeal growths stimulated by radium application. The results obtained by Dr. Pfahler were decidedly different from my results; they were possibly the result of better application technic. I have abandoned all radium therapy except the use of embedded platinum radium seeds which give promise but are too new to allow me to estimate their value definitely. On account of the unsuccessful results secured in New York in the treatment of laryngeal cancer by radium, there is a general sentiment in that city toward abandoning such therapy in this malady.

Dec. 15, 1926

Fielding O. Lewis, M.D., *Chairman*

Presentation of New Instruments.

Dr. George Fetterolf demonstrated a new type of chisel for the removal of the bony ridge in submucous resection of the nasal septum.

Dr. George M. Coates showed an electric device for the application of vaporized iodine in the treatment of the eustachian tube.

Dr. Curtis C. Eves demonstrated a new type of mastoid retractor and a case for the carrying of small knives.

Unusual Types of Mastoiditis. Presented by Dr. S. Mac Cuen Smith.

With the exception of an occasional instance in which mastoiditis develops secondary to trauma or metastatic infection, it is conceded that the disease is secondary to inflammatory of the eustachian tube and tympanic cavity. If the tube remains patulous and the membrana tensa only is involved, serious mastoiditis is unlikely. If the vault is invaded and communication with the lower portions of the tympanic cavity blocked by swelling, and if the process is a suppurative one, the mastoid is always involved. The development of mastoiditis requiring surgical intervention, especially when the vault is involved, depends on the absence of free drainage, the virulence of the infection, the resistance of the patient and the composition of the osseous structure.

When the mastoid cortex is sclerotic and thick, the danger of intracranial complication is greater than when it is possible for an external fistula to develop. Many cases do not present the classical textbook symptoms.

The continuation of fever and abundant discharge is a grave sign. The absence of fever, when otorrhea is present, does not rule out mastoiditis requiring operation. When symptoms of mastoiditis occur after the discharge has ceased surgery is necessary. In some cases the tympanic membrane is little changed. In such cases, the canal is usually swollen. Narrowing of the canal, when it is not due to furunculosis or otitis external diffusa, is an indication for a diagnosis of surgical mastoiditis.

When a copious purulent discharge is present at the end of four or five weeks, even though other symptoms are absent, mastoiditis necessitating operation is present. As a rule, when multiple myringotomy must be performed, operation on the mastoid is necessary.

Four cases were reported.

The point of interest in the first case was that mastoid disease developed without a suppurative otitis media. Some redness of Shrapnell's membrane and of the long handle of the malleus was present, but no other indication of middle ear disease. The few signs of mastoiditis over the mastoid process could be explained by the presence of furunculosis of the canal. The roentgen ray showed clouding of the mastoid, and operation revealed pus under pressure. The tube and middle ear had no doubt first been involved but had largely recovered.

A second patient was operated on in whom mastoid pus with erosion of the sinus plate was found. This patient had his initial symptom, consisting of pain on the right side of the head of four days' duration, three months previous to surgical intervention. This pain subsided, but returned in a month, with swelling posterior to the mastoid extending almost to the occiput. This condition again subsided, to recur much more pronounced two months later. In this case also mastoid infection occurred with little evidence of a pathologic condition of the tube or middle ear.

In a third case, operation on the mastoid was necessary when profuse discharge and pain failed to disappear after multiple myringotomy. Local evidence of mastoiditis was not present. The cortex was extremely thick and the dura was exposed.

In a fourth case, otitis media and later mastoiditis requiring surgical treatment followed furunculosis externa without tubal infection.

DISCUSSION

Dr. George M. Coates: The mastoid case with the classical textbook symptoms is easy to diagnose. The difficult cases are those in which few signs and symptoms are present. Such atypical cases without middle ear involvement were originally called primary mastoiditis. I believe that all these patients at one time have had middle ear involvement, perhaps mild in character. I have seen many patients who have showed mastoid disease with no objective or subjective evidence of middle ear disease. A detailed history is of great value. Any acute respiratory infection is of significance. The tympanic membrane may not show any signs. In the interpretation of roentgenograms one should always bear in mind that previous middle ear inflammation may have changed the picture. The presence of a discharge from the ear is important. Discharge over an extensive period accompanied by fever usually requires operation. The same is true when multiple myringotomy is indicated; sagging of the posterior canal wall or narrowing of the canal by inflammation is one of the most important signs. Sometimes the infection is confined to the anterior horn of the zygoma. Such cases may simulate mumps. I should like some information concerning the diagnosis of masked mastoiditis in infants showing gastro-intestinal symptoms.

Dr. Mathew Ershner: I consider the red blood cell picture of some value in the diagnosis of mastoiditis necessitating operation. Early in the disease typical obstructive deafness is present. Later the deafness is mixed. Loss of some of the high tones will occur. After-treatment by politzeration is important.

Dr. Arthur Wagers: A patient who had furunculosis later developed otitis media. Myringotomy was necessary. Later mastoiditis requiring operation developed.

Dr. Karl M. Houser: An infant, aged 8 weeks, who was cared for at the University Hospital, had a bilateral otitis media requiring myringotomy. The ears became dry, and the child improved. Some weeks later, frequent vomiting and elevation of temperature occurred. The ears were objectively normal, and myringotomy did not produce pus. So profound was the emaciation that in the absence of other symptoms it was considered justifiable to open the mastoid antrums. A small amount of thick pus was found in each. Vomiting ceased immediately, and there was an elevation of temperature for a long time following operation. The infant gained weight and eventually recovered.

Dr. Smith: The unusual cases of mastoiditis frequently seem much less atypical and unusual when thoroughly studied. Study of the roentgenograms by the surgeon is helpful. If the posterior canal droops, operation is seldom avoidable.

Jan. 19, 1927

George M. Coates, M.D., *Chairman, pro tem.*

Salivary Calculus of the Submaxillary Gland Associated with Infection. Presented by Dr. Arthur Wagers (by invitation).

About 60 per cent of salivary calculi are found in the submaxillary gland. The calculi composed essentially of calcium phosphates and carbonates are considered to be secondary to infection. Years may pass before these calculi manifest any symptoms. The case of a woman who had a stone in the right submaxillary gland associated with severe local infection was presented. The calculus was shown by the roentgen ray and removed surgically under local anesthesia. Reference was made to the proximity of the lingual and hypoglossal nerves to the submaxillary gland, and to the necessity for using care in order to avoid injury to these structures.

DISCUSSION

Dr. George B. Woods: In several cases of submaxillary calculi, I removed the stones surgically.

Dr. Harry A. Rothrock: Symptoms of sublingual pain and fulness at the time of eating caused by the pressure of retained saliva are important.

Dr. George M. Coates: In one case, the submaxillary calculus was so mobile that its removal was difficult.

Dr. Karl M. Houser: A negro experienced recurrent blockage of Wharton's duct. On three occasions the duct was dilated, and each time a branching yellow cast of the duct was expressed. This cast microscopically was amorphous, showing neither cells nor crystals. Relief of sublingual discomfort immediately followed the removal of the cast.

Dr. Arthur Wagers: In another case the stone was expressed spontaneously from Wharton's duct.

PERIPHERAL PARALYSIS RESULTING FROM FOCAL INFECTION. Presented by DR. WALTER L. CARISS (by invitation).

Two cases of peripheral paralysis resulting from focal infection were reported. The first was that of a colored infant with a right-sided mastoiditis and a left facial palsy. The left ear drum was slightly inflamed, but otherwise the ear and mastoid on that side were normal. Both mastoids were operated on, and both were found to be greatly necrosed and filled with pus. Complete recovery from the paralysis followed within six weeks.

The second case was that of a man who nine days before admission to the Presbyterian Hospital began to experience numbness of his lower extremities. This condition was rapidly progressive, so that in a few days he was unable to move his legs or hips, and lost most of the power in his arms. A diagnosis of multiple neuritis was made. Complete study and examination revealed only clouding of the left frontal, ethmoid and maxillary sinuses.

An open operation of these sinuses under ether anesthesia was followed by the patient's discharge from the hospital on the twenty-first day, apparently completely recovered. Three years have elapsed since this procedure, and to date the patient has not had a recurrence.

DISCUSSION

DR. NATHAN P. STAUFFER: It is necessary to study thoroughly all cases of peripheral neuritis in an attempt to discover infective foci.

DR. GEORGE M. COATES: A man with facial paralysis recovered following a mastoid operation. Little evidence of mastoid disease was present.

OPENING THE BITE ACCORDING TO THE WADSWORTH TECHNIC OF ARTICULATION AND ITS EFFECTS ON THE TEMPOROMANDIBULAR AREA. Presented by DR. F. G. HAWKSWORTH (by invitation).

Many disturbances of the ear, such as deafness and tinnitus, are secondary to a retrogression of the mandible. This commonly occurs in middle life and following the loss of teeth. A muscular imbalance is produced resulting in a backward thrust of the mandible encroaching on the auditory canals. This idea was first brought forth by Dr. George S. Monson of St. Paul.

Habitual retrusion of the mandible causes pressure and gradual resorption of the interarticular cartilage and the surrounding joint structures, which may include part of the tympanic plate. Backward pressure may result in almost complete closure of the aural canal, together with continued pressure and irritation of the tympanic plate. The foregoing observation is that of Dr. Walter Henry Wright of Pittsburgh.

A line drawn from the center of the pupil to the line of the lips (mouth closed) should equal a line from the nasal septum to the mental process; if the latter line is shorter than the former, imbalance is present. Patients with such cases are treated by the fitting of artificial dentures which gradually restore the mandible to its proper position. Sometimes this treatment requires eighteen months for completion and the production of from four to six dentures.

DISCUSSION

DR. THOMAS AIKEN: What procedure is to be followed when imbalance is present with a full complement of teeth?

DR. GEORGE B. WOOD: Have any changes been observed in the aural canal?

Dr. George M. Coates: Which aural cases should be considered proper cases for such appliances? How is a differential diagnosis established?

Dr. Benjamin Shuster: The glenoid fossa is so far beneath the ear structure that it is doubtful whether the disturbance mentioned would influence hearing or tinnitus.

Dr. Hawksworth: If a full complement of teeth is present but there is imbalance correction is brought about by the application of crowns or cusps. I have not seen encroachment or closure of the aural canal.

A Review of the Year's Work on Laryngeal Tuberculosis. Presented by Dr. George B. Wood.

This article was published in full in the issue for December, 1926, page 527.

DISCUSSION

Dr. Curtis C. Eves: I find the cautery most useful in selected cases of laryngeal tuberculosis. The quartz light tubes promise to be of value.

Dr. Gabriel Tucker: I recently performed a tracheotomy for dyspnea in a case of laryngeal tuberculosis. Remarkable improvement followed. Radium or the roentgen ray will probably produce chondritis or perichondritis.

Dr. Philip Stout: I have used tracheotomy in about twelve cases. In no case was there regret that the operation had been performed. In my cases tracheotomy has frequently relieved dysphagia. Sun baths and injection of the superior laryngeal nerve with alcohol are of value.

Dr. George B. Wood: I have not seen any patient relieved from dysphagia after tracheotomy. I use this operation only for the relief of dyspnea.